Rubber Journal and International Plastics

VOL. 138 NO. 17 APRIL 23 1960 Price 1s. Weekly

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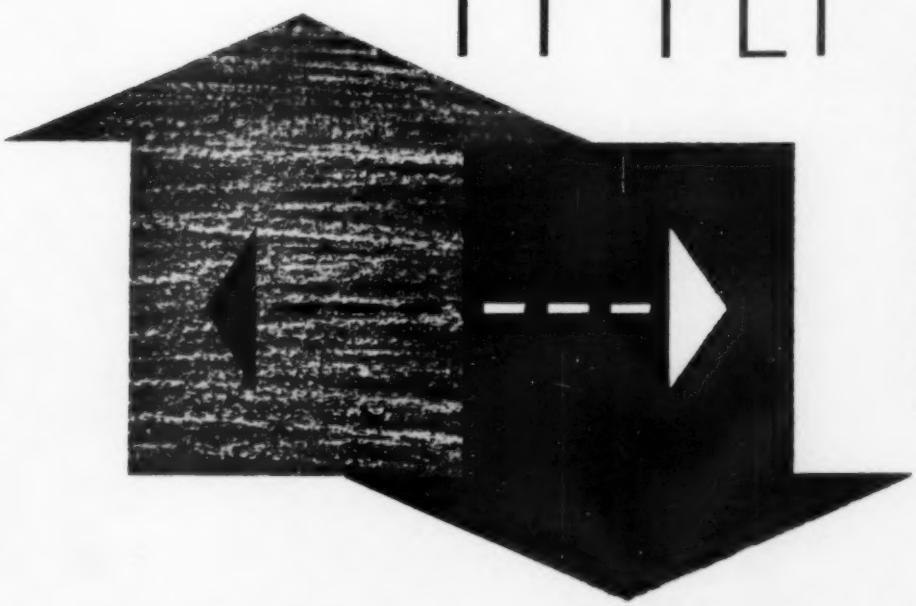

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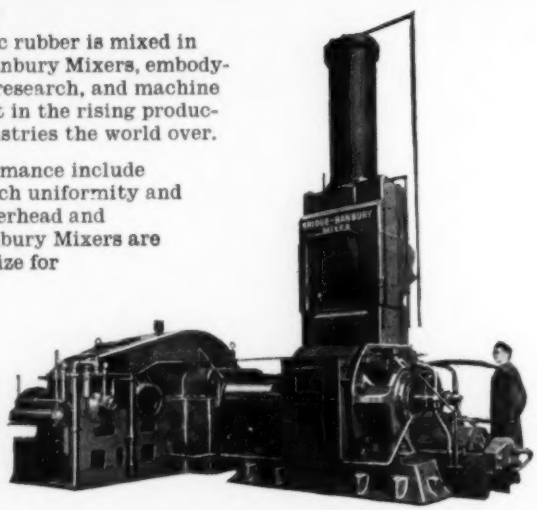

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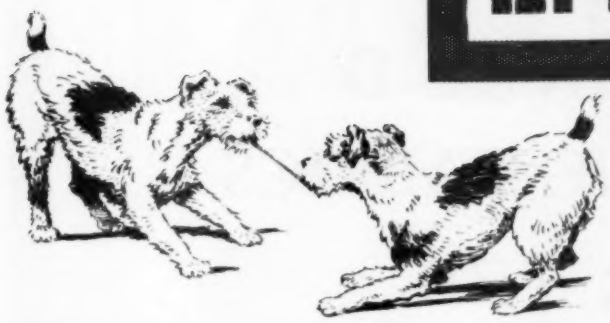

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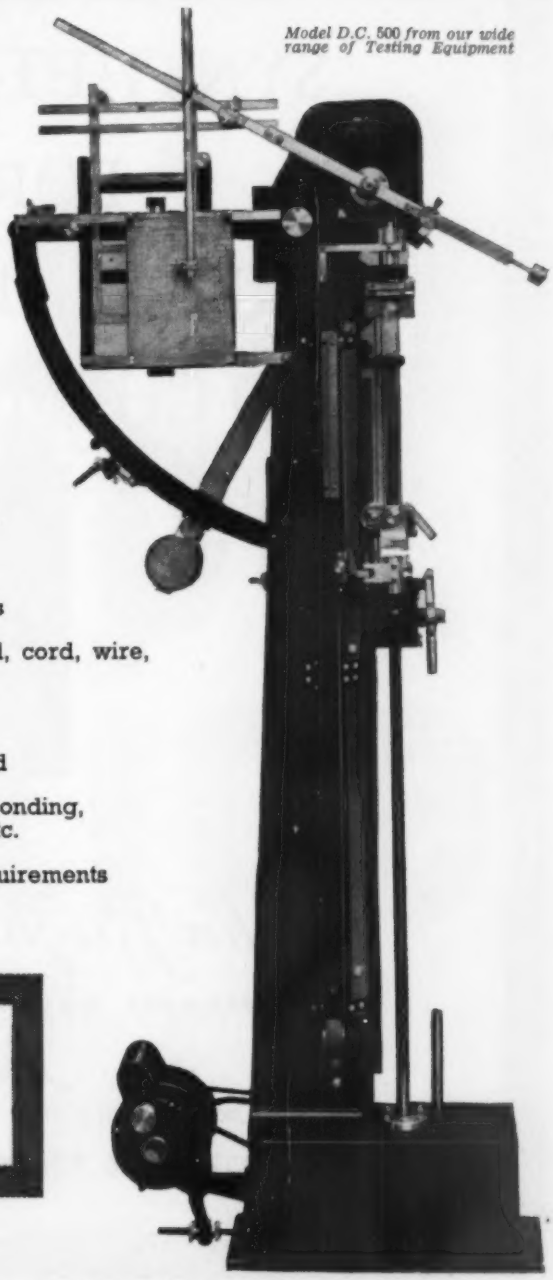

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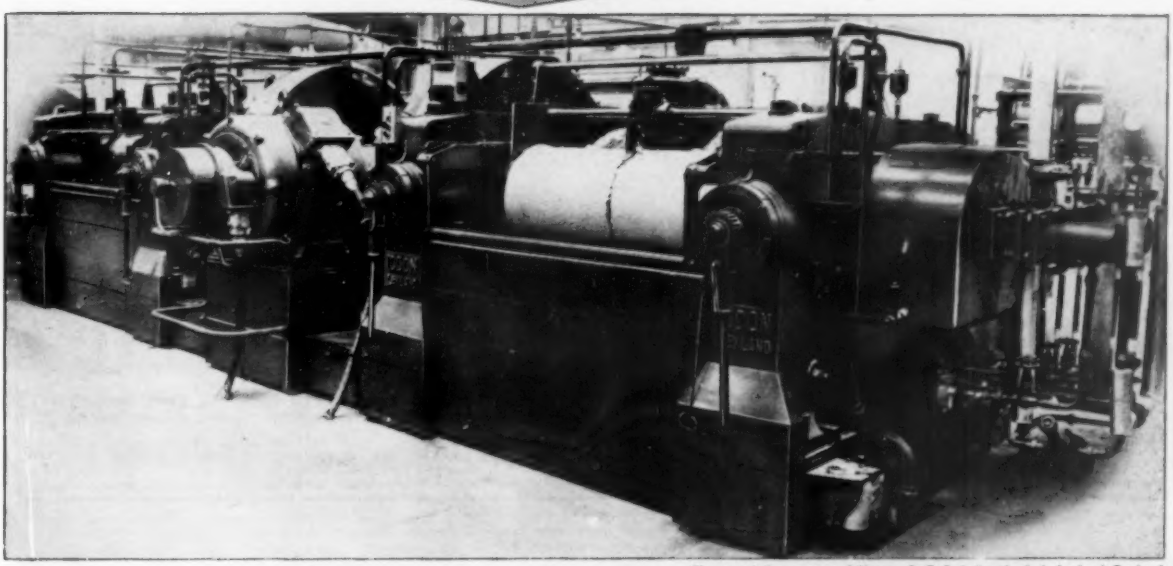

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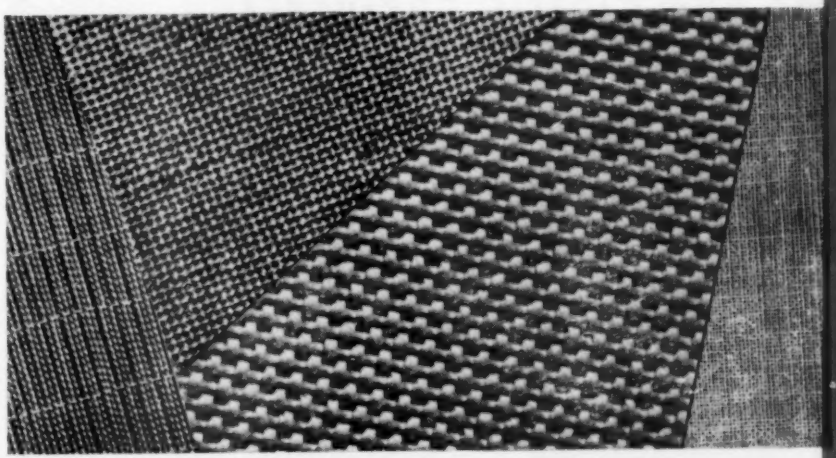

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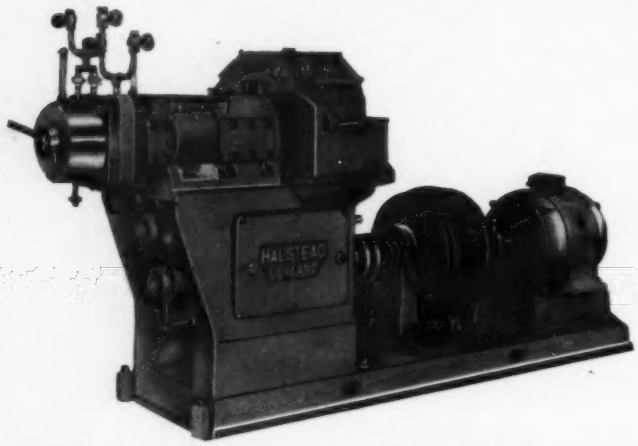

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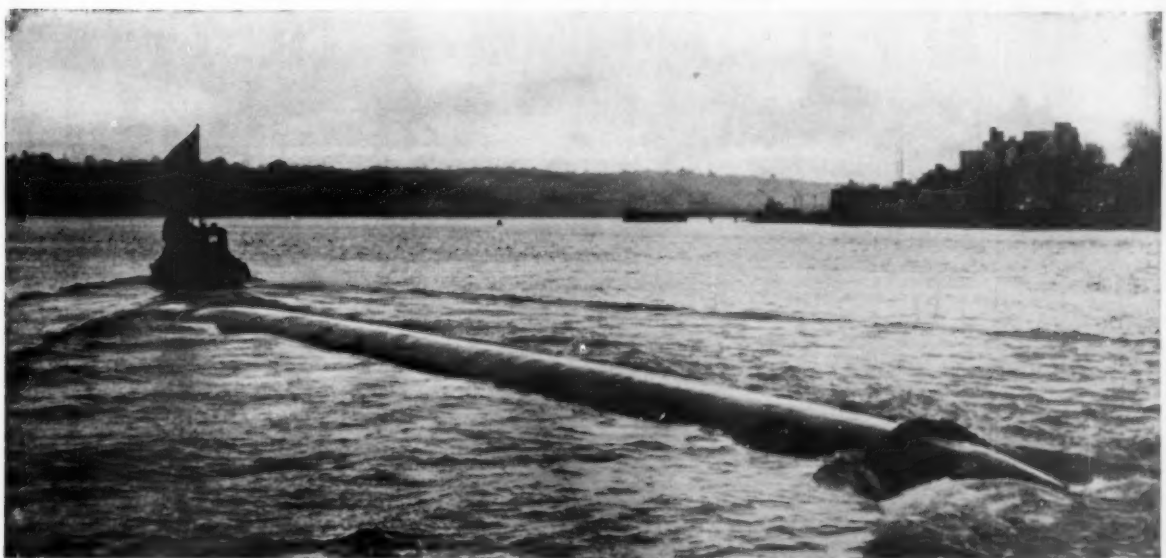

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Rubber Journal and International Plastics

Volume 138 **Price 1s. Post free 1s. 4d.** **No. 17**

IN ITS 76th YEAR

April 23 1960

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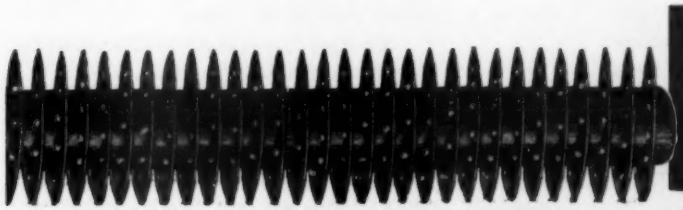

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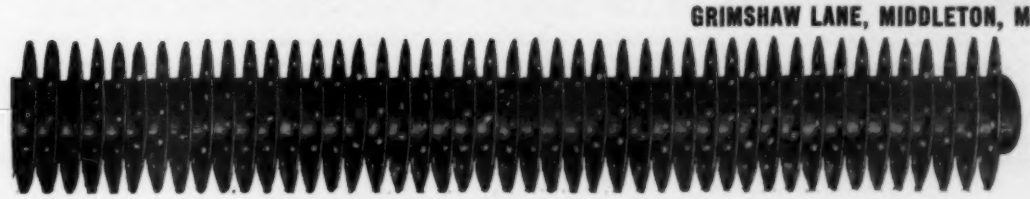

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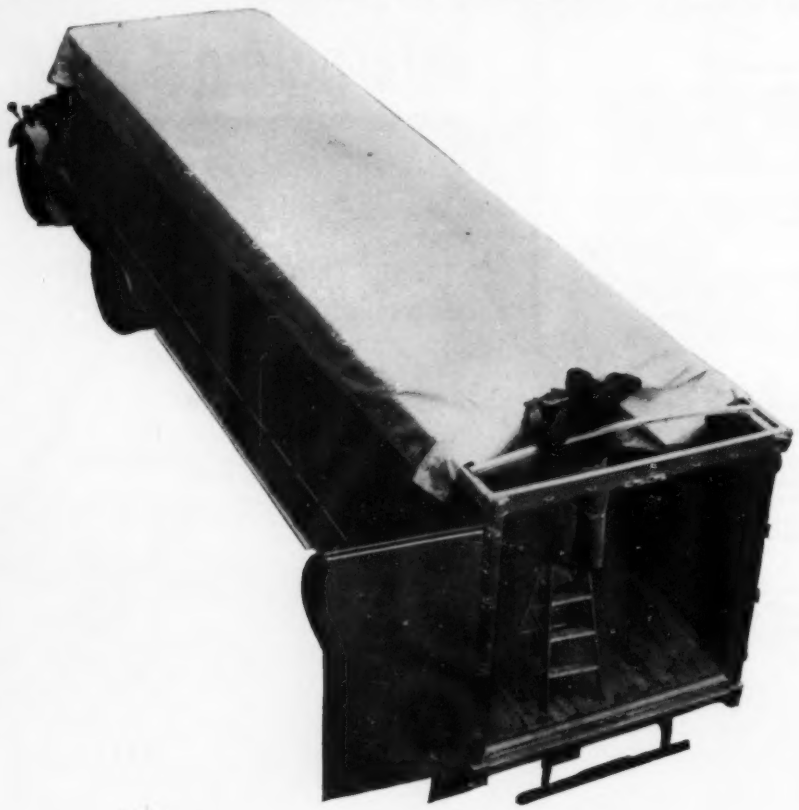

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NOTES of the WEEK

EEC Trade

THE economic survey of Europe in 1959, prepared by the United Nations Economic Commission for Europe and published on April 13, notes that while all the highly industrialized countries of western Europe took part in the expansion of intra-trade, the predominant element was the growth of trade of the European Economic Community countries. These accounted for 73% of the rise of imports in intra-trade and for almost 80% of the increase in exports. Especially notable was ' the development of West German imports which accounted for about two-fifths of the rise in intra-western Europe trade and for more than half of the rise in the imports of Common Market countries from Western Europe.' (An article on selling to Western Germany by H.M. Minister (Economic) in Bonn, appears on page 608.)

Apparently the relatively faster rise in EEC trade, and particularly mutual trade, cannot be explained by different rates of industrial expansion. On this point the survey comments: ' It therefore seems likely that trade inside the Common Market has intensified very largely in response to the first stages of the implementation of the Rome Treaty, and—doubtless more importantly—in anticipation of the further stages of this process.'

Political Schism

COMMENT on the trade position in Europe is made by Col. C. W. Clark, chairman of Alfred Herbert Ltd., in his statement circulated with the Company's accounts. The conflict of interests of the ECC on the one hand and the European Free Trade Area on the other, he says, has naturally caused us some concern in view of our substantial trade with all the free countries of Europe. Unless some way can be found of enabling the two groups to work together for the furtherance of mutual trading, it seems inevitable that some form of political schism will develop which could have far-reaching effects on the prosperity and even the safety of Europe.

Europe Will Not Wait

FURTHER comment on the subject is contained in a book just published, ' Europe Will Not Wait,' by Mr Anthony Nutting. In this, a formidable indictment of Britain's European policy since the war, Mr Nutting states that by walking out of the Spaak Committee during the formative stages of the Common Market, Britain as good as missed her last chance to play the leading part in Europe. He points out that a British offer to join the Common Market would do no good at the moment—it would be blocked. He goes on to make an intriguing suggestion; a merger of the Common Market and the Commonwealth. Clearly in this idea there is an enormous potential for the good of all concerned.

To return for a moment to Col. Clark's statement, he said that there were no signs that the Company's trade with Common Market countries was in any immediate danger. They were, however, going to watch developments carefully and might if necessary consider the advisability of extending manufacture, possibly in France where their associate company had for many years been building machines.

Some machinery manufacturers in the plastics industry, notably BIP (Bipel-Maschinen GmbH) and R. H. Windsor, have, of course, already successfully taken this step, while a number of plastics and rubber companies have either associated companies or manufacturing agreements within the area. It seems a pity that British manufacturers of plastics materials have not so far established plants in EEC countries. The probable continuation of present marketing trends in these materials in EEC countries must inevitably constitute a danger to our sales in the Common Market.

Research Expenditure

BRITISH manufacturing industry spent about £300m. on research and development in 1958, compared with about £190m. in 1955. This represents 4.2% of manufacturing industry's contribution to national production compared with 3.1% in 1955. Of the £300m. 95% was spent in industry's own establishments, and about 5% on payment to outside bodies such as co-operative research associations, universities and other public and private research institutions. These estimates are contained in a DSIR survey on ' Industrial Research and Development Expenditure 1958 ' published on April 13. The main expenditure on research and development for the year under review was in aircraft (£100m.), electrical engineering (£64m.) and chemicals (£43m.).

These estimates of expenditure are based on the estimates of the distribution of qualified scientists and engineers engaged on research and development provided by a survey carried out in January 1959, by the Ministry of Labour and National Service for the Advisory Council on Scientific Policy.

No breakdown is given for the rubber and plastics industries, although the figure for chemical and allied trades is of interest. This totalled, in 1958, £43m., 14.5% of the total spent in all industries. Of this, £42.4m. was spent in industry's own establishments. The last available figure for the rubber industry is that given in the 1955 Report, £1,646,000.

NEWS *Briefs*

DOW IN DUTCH PHENOL PLAN — NEW RESINS PRICED — UK-CZECH AGREEMENT — USSR BUYS FROM UK—RUBBER FROM SUGAR—INDIAN PLANS

●**United States** — The world-wide production facilities of the Firestone Tire and Rubber Company are currently being expanded by a $120m. construction and modernization programme, according to Mr Harvey S. Firestone, Jun., who is to participate in the dedication of a recently completed tyre plant at Alcochete, Portugal. Included in Firestone's plans are five new plants. Tyre manufacturing facilities are now under construction in Calgary, Alberta, and Bethune, France. Synthetic rubber plants will be constructed in Port Jerome, France, and Bareilly, India, and a new plant will be completed this year in Orange, Texas, for the production of coral and diene synthetic rubbers.

●**Brazil**—According to the annual report of Petróleo Brasileiro SA for 1959, work on the construction of the Duque de Caxias refinery proceeded more rapidly last year. Preparatory work has also been carried out on the expansion of the President Bernardes and Gandulpho Alves refineries. Work has been started on the construction of the synthetic rubber plant which will be established near the Duque de Caxias refinery and have a capacity of 40,000 tons per annum.

●**Chile**—The Empresa de los Ferrocarriles del Estado, Chile, has called a tender for 413 lots of chemical products, galvano-plastic materials and laboratory equipment. Final date is April 29 1960.

●**United States**—Marlex medium and low density polythene, which Phillips Chemical have announced they are to market (*RJIP*, April 9, 532), will be competitively priced. Most of the new resins will sell for 32½ cents a lb. on shipments of 20,000lb. or more. Five resins are designed for various film applications; two each for the fields of blow moulding, coatings and injection moulding and one each for pipe and wire and cable coating.

●**United States**—Dr Walter G. Frohlich has become managing director of European Operations for the international Division of Century Chemical Corp. He had been associated with Chemo Puro AG, recently acquired by Century. Dr Frohlich's activities will include the co-ordination, direction and supervision of foreign sales, licensing, acquisitions and manufacturing in the UK, Scandinavia, Continental Europe, North Africa and the Middle East.

●**Brazil**—President Kubitschek has approved the recommendations of a working committee, set up by the Sudene, in favour of the installation of a synthetic rubber plant in the State of Pernambuco. It would use alcohol from cane sugar as a basic raw material.

●**Argentine** — The Ministry of Economy has approved the investment of US$450,000 by George S. Gregory and Empire Commercial Corporation of the USA, through the local concern 'Maplast,' in machinery, equipment and tools for the manufacture of plastics floorings.

●**Czechoslovakia**—Under the terms of a new Anglo-Czech trade agreement, Czechoslovakia is to import £5.3m. worth of goods from the UK—one of the main items being plastics. The agreement replaces the previous one and is to last for three years.

●**India**—The Minister of Commerce reporting on the steps the Indian Government was taking to promote rubber production, said suitable lands for rubber cultivation on a commercial scale in the islands of Andaman and Nicobar were being surveyed and plantations were likely to start in the islands shortly.

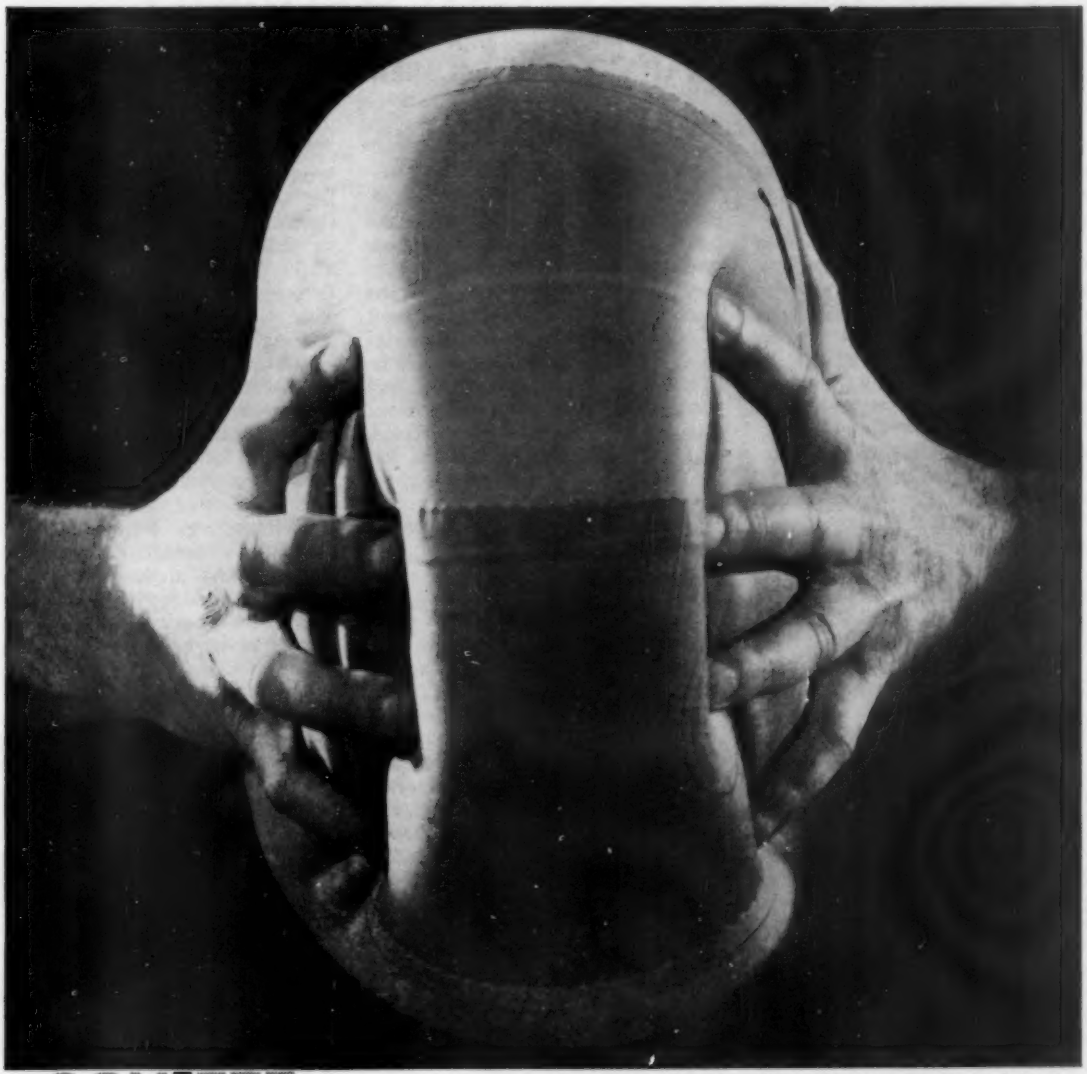
●**Russia**—A large synthetic rubber plant at Sterlimak, in the Bashkir Autonomous Republic on the Volga, has started production, according to the Soviet new agency Tass.

●**Malaya** — The Malayan Government has announced it will send three members from the Rubber Research Institute to South India to advise the Indian Government on methods of more efficient rubber production. These services are being offered to India under the Colombo Plan.

●**Holland** — A new phenol plant is to be built near Rotterdam. It will be a joint venture between Dow Chemical Co. and the Netherlands State coalmines. Some of the phenol will be used by AKU as an intermediate in nylon manufacture. The rest will be marketed by Dow.

●**United Kingdom** — The Soviet Union has bought a further 4,000 tons of natural rubber for immediate shipment from the British stockpile. It is understood that the rubber will be shipped immediately in Soviet vessels. This second Soviet purchase direct from the Board of Trade follows that of 3,000 tons a month ago.

'Let's face it — after 56 years we can safely assume you boobed when you planted the damn thing.'—481



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Selling to Western Germany

LARGE AND GROWING MARKET FOR RUBBER AND PLASTICS GOODS

By J. A. M. MARJORIBANKS
H.M. Economic Minister at Bonn

I THINK every industrialist and manufacturer reading this journal should take another look at the possibilities of Western Germany as a market.

The idea that exporting to Germany is like sending coals to Newcastle is untrue. The facts prove it. Imports into Western Germany from the United Kingdom in 1957 totalled some £97m.—over half of this industrial goods. In 1959 these imports had risen to £139m., an increase of 20% over 1958. Western Germany is now in fact the UK's largest export market outside North America and the Commonwealth.

In particular, Germany offers a large and growing market for rubber and plastic goods. Both production and consumption of these in the Federal Republic have been increasing with the steady progress of industrial development, although the multitude of products involved make it difficult to describe the market in detail. Germany is, of course, one of the leading manufacturing countries of both these lines, and imports of manufactured rubber and plastic goods are comparatively small in relation to home production. But they have been growing over the past few years.

For purposes of comparison, one may note that German production increased from 415,000 tons in 1958 to 466,000 tons in 1959. Between 1958 and 1959 imports of rubber products increased from 22,000 tons, valued at DM85m. to 31,000 tons, valued at DM123m. Germany's rubber exports are something like double her imports. Imports of all rubber goods were completely liberalized as from January 1 1960, when tyres, tubes, rubber thread and cord were liberalized from all countries of origin; they had previously been liberalized only for OEEC countries.

Main Imports

Tyres, including tubeless tyres, are easily the most important item of rubber imports, and these increased from about DM46m. in 1958 to DM64m. in 1959. The leading suppliers were, in order, Sweden, Austria, the UK, France and the Netherlands.

Other principal imports are rubberized and elastic textile fabrics, rubber thread and cord, pipes and tubes, hygiene and surgical rubber products, rubber belting and rubber clothing and gloves. The UK has a small share of the market in most of these lines—it is, in fact, the principal supplier of rubberized textile fabrics and rubber clothing and gloves—and there is reason to believe that this share could be increased. There are no quota restrictions, and the tariff level is not prohibitive—11% or 14% according to the type of goods plus turnover equalization tax of 4% or 6%.

Many Openings

A similar picture is presented by plastics. German imports of raw and semi-finished plastics materials increased between 1958 and 1959 from 101,000 tons valued at DM284m. to 127,000 tons valued at DM333m., while imports of finished products also rose between the two years from 3,600 tons, worth DM33m. to 5,000 tons, worth DM45m. Among the raw and semi-finished materials, an item which strikes the eye is imports of plastic sheeting, which were valued at DM87m. in 1959; of this total USA supplied DM33m., Italy DM14m., and the UK DM8m.

It is impossible to follow individual products statistically, but there is good reason to suppose that there are many openings for new or higher quality British products if they were brought to the attention of the German user industries. Twenty-eight British firms took part in the International Plastics Fair in Düsseldorf last year, representing the third largest foreign contingent after France and Italy, and some of the exhibiting firms were surprised at the volume of interest expressed by buyers from Germany and foreign countries.

The future of our trading relationship with Europe is, of course, far from certain. On the one hand, there is the prospect that Germany's membership of the Common Market will cause discriminatory tariffs against our goods. On the other, there is the more hopeful prospect that the formation of the European Free Trade Association will be followed by an association with the six Common Market countries including, of course, Western Germany. In either case, the sooner we take the measure of German competition the better; and this can only be done in the German market itself. Whatever happens in Europe we cannot afford to lose touch with its biggest and most rapidly-growing market.

You may be uncertain about how best to set about the West German market; and you may not know of the help there is available. To help find agents for British firms and assess market possibilities, we have full-time commercial officers in Düsseldorf, Hamburg, Bremen, Hanover, Frankfurt, Stuttgart, Munich and West Berlin; these officers have detailed knowledge of local conditions and openings, and are well placed to give advice to British exporters. We are linked with all these posts by a teleprinter network; between us we are handling well over a hundred requests a week from British firms seeking agents or information about the West German market; in addition we send back to the Board of Trade every month a detailed report on economic developments in Western Germany. We also make a number of appreciations of market possibilities for particular lines of British goods. We do not claim to be experts—we handle enquiries for all lines of goods—and our resources are far from unlimited. But we can give you advice based on local knowledge.

Spot Assessment

Success in the West German market is not easy. Western Germany is a highly competitive market and it would be misleading of me to guarantee, in every case, success. But I believe that British industry has a great deal to offer which is second to none. One proof of this is the fact that our exports of manufactured goods to Western Germany have increased over fourfold over the last five years.

I recommend you to consider coming to Germany—or sending someone out here—to make an expert assessment on the spot of the prospects for your goods. If you will let us know in advance we will be happy to arrange contacts and inter-

Continued on page 609

Russia's Rich Reserves

POLYMERS AND PROGRESS IN UZBEKISTAN

MIRHOJA ASKAROV, scientist of the Uzbek Academy of Sciences' Institute of the Chemistry of Polymers, in the USSR, stated recently at a conference of chemists in Tashkent, that within a score of years Uzbekistan will have developed the manufacture of all polymeric materials of major importance to modern technology. Their production is to be organized this year.

He declared that Uzbekistan is the home of the USSR's richest reserves of polymeric raw materials. High molecular compounds will be produced out of cotton and cotton plant stalks (the republic grows two-thirds of the country's cotton), natural gas, reeds, oil, coal and other raw materials.

Tashkent mills will soon be manufacturing on a large scale fabrics from cotton chemically treated to lend it, it is said, the properties of the best synthetic polymers. Production is being organized of heat-resistant coatings and scores of other compounds from furfurol, a product of the hydrolysis of cotton stalks. Plants are under construction for the production of acetate silk from natural gas.

Uzbekistan's machine building industry is preparing for the large-scale application of plastics as construction material, and is already manufacturing 300 plastic parts for the textile and earth-digging machines. Work on the use of plastics for the manufacture of 50 cotton-picking machinery parts is nearing the testing stage.

The first contingent of specialists in the field of synthetic fibres and plastics for work in industry will graduate from Uzbek higher educational establishments next year. Four scientific centres to study the chemistry of polymers have been built in the republic in the past year.

Selling to Western Germany

Continued from page 608

views and, needless to say, we should be very happy to welcome you ourselves. For there are great opportunities on the West German market—opportunities which any British firm cannot afford to miss.

Manufacturers and others interested can write to Mr Marjoribanks at the British Embassy, Bonn, Friedrich-Ebert - Allee 77—telephone Bonn 22021. Arrangements can be made for finding an agent—in this case two dozen copies of descriptive literature should be sent, together with prices cif Hamburg or Düsseldorf in DM. Enquiries can then be made by several of the consular posts simultaneously.

Hytex Extension

Work has started on the demolition of houses facing the Latimer Road, Hammersmith, factory of Hytex Ltd. On the site, when cleared, a three-storey office block will be erected.

Mr R. Surridge, founder of Surridge's Patents Ltd., and Holdtite Stick-on-Soles Ltd., has died. He was in his 88th year.

The Six, the Seven and the Commonwealth

A three day course which will review the effect of the European Economic Community and Free Trade Association on the Commonwealth's economic and trading relations both with Britain and the Continent will be held from May 4. Called 'The Commonwealth and Europe,' it is sponsored by the Federal Trust for Education and Research and will be held at St. Ermins Hotel, Westminster. It is designed for business executives at director level.

On the first day questions dealt with will be the probable effects of the EEC and the FTA on the Commonwealth, Commonwealth attitudes and interests, the economic effect on the demand for raw materials and food produced by the Commonwealth, and the effect on certain commodities (including fibres). Prospects of growth in Commonwealth countries will be dealt with on the second day and the third day will open with a description of the prospects for exports of manufactures from Commonwealth countries to Britain and Europe.

Among the speakers and chairmen of the various sessions will be John Ryan (vice-chairman, Metal Box), W. E. K. Piercy (director, Albright and Wilson), Miss M. G. Hampshire (Courtalds) and Lionel Andrews (managing director, Lionel Andrews Rubber Co. Ltd.).

Big German Investment

The three biggest chemical companies in West Germany are expected to invest DM1,000m.—about £85m. —this year. They are Badische Anilin-und-Soda Fabriken, Farbwerke Hoechst and Farberfabriken Bayer.

American holdings in all three companies went up last year, and one of the companies, Bayer, is said to be considering applying for quotation on the London Stock Exchange. According to a *Financial Times* report all three companies are worried about the results of a possible division of Europe between the 'Six' and the 'Seven,' though the directors say they expect the two groups eventually to come to terms.

The relative volume of their exports to the two areas makes this desirable. 27% of Hoechst's exports in 1959 went to the EFTA, and only 24% to the Common Market. In the case of BASF it was 22% to the Common Market, 19% to the EFTA. Figures for the industry as a whole were 27% of total exports to the EFTA, 24% to the Common Market—with the latter growing more quickly.

Japanese Polypropylene Moves

Several Japanese firms are said to be actively contemplating the 'domestic industrialization of polypropylene.'

It is reported that Mitsui Chemical Industry Co. Ltd. and Mitsubishi Petrochemical Co. Ltd. are seeking Government approval by the beginning of May for the introduction of technical know-how from Montecatini. Both firms have signed provisional contracts with Montecatini.

Two other firms, Nissar Chemicals and Ube Kosan are said to be approaching Montecatini, and Shinnippon Chisso is said to have concluded a contract with Avisun Corp. for sole sales rights of Avisun polypropylene and products in Japan. Sales activities are already in progress. The firm will import polypropylene, moulding resin and fibre and later it plans to produce itself, using Avisun know-how. Capacity would be, it is estimated, about 12,000 tons a year initially.

New Polymers

VINYL CYCLO-ALKALENES — POLYPEPTIDES — POLYACETALS

THE second day of the Plastics Institute Conference: 'Polymeric Progress' opened with a paper by Profs H. F. Mark and M. Goodman (Polytechnic Institute of Brooklyn, USA) delivered by Professor Goodman and titled 'New Polymers: New Problems.' He referred to Professor Overberger's work on the stereospecific polymerization of vinyl cycloalkalenes and, in particular, to vinyl cyclo-propane. Various routes had been tried to obtain the monomer but all gave low yields, the best, pyrolysis of the xanthate, giving about 50%. Polymerization was carried out in n-heptane solution using aluminium isobutyl + titanium trichloride as initiator and this gave a polymer 66% iso- or syndio-tactic, 34% amorphous. There is less steric hindrance than in polypropylene (due to the angle of orientation of the ring) and this gives easy packing with a small repeat distance (2.52 Å —correct for a planar zig-zag—was given in the discussion).

It was hoped that treatment of the crystalline polymer with reagents which opened the cyclopropane ring would yield tactic derivatives but, in fact, all the reagents tried, including HBr, oxidation and Friedel-Crafts reagents, gave rise to amorphous polymer. The explanation of this seems to lie in rearrangement during ionic cleavage reactions (Fig. 1).

Charge transfer occurs to the tertiary carbon atom which is trigonal and non-stereo active. It was thought possible that the reaction of bromine at the double-bond might lead to retention of tacticity but in practice the HCl formed disturbs this.

The second part of Professor Goodman's lecture concerned the structure of polypeptides. The transamides exist in two structures (I) involving intermolecular hydrogen bonding and (II) involving intramolecular hydrogen bonding. These forms appear to exist both in the solid state and in solution. The problem 'How many (II) units would have to be present in the structure in solution in order to stabilize a helical configuration?' is complicated by the presence of an alternative 'random coil' structure. Optical activity was used for determining conformation in solution. Solvents which interfered with hydrogen bonding favoured the random coil, the helical structure appearing in the presence of solvents which did not interact with the polypeptide chain.

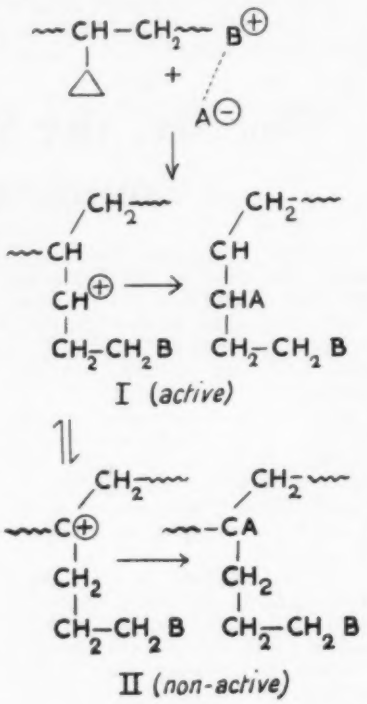

Fig. 1

An anomaly which had to be investigated was that these results should be independent of concentration but, in fact, were not. It was thought that this might be due to association in solution and models were built of possible associated and helix structures. There exists a possibility of hydrogen bonding at the pentamer stage by folding of the chain which might explain the discontinuity in the curve of rotation v. no. of residues (Fig. 2). Further analysis has been carried out using a mathematical relationship between optical activity and molecular asymmetry and the concept of a 'coefficient of helicity' has been developed. Using this approach, it has been possible to show that each molecule which is helical is completely helical.

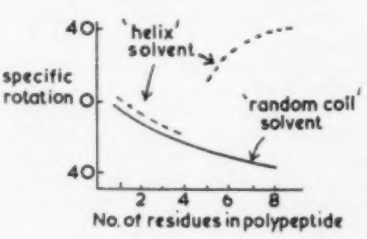

Fig. 2

Points raised in the discussion included the use of infra-red absorption methods for determining conformation in solution where difficulties arise due to the small frequency differences in for example the C = O stretching frequency between one structure and the other; also, the large effects of 'end groups' at these low D.P.'s. It was agreed that amorphous character is not necessarily related to tacticity. Other vinyl cyclo-alkanes with other catalysts are being investigated, also the use of non-ionic ring opening reagents. Atactic polyvinyl cyclopropane has too low a molecular weight to show rubbery properties. A Russian delegate, Professor V. V. Korschak, reported difficulties due to racemization of optically active intermediates. Professor Goodman confirmed this, which had interfered with their work in the early days and he described the numerous elaborate purification and structural characterization methods currently in use at Brooklyn.

Acetal Polymers

Dr Linton, in delivering his paper on acetal polymers, reported that over 300 technical man-years had been spent on the development of 'Delrin' reported in his paper. Many attempts have been made previously to polymerize formaldehyde but they have not resulted in producing a technically valuable product.

Polymerization may be carried out using either nucleophilic or electrophilic initiators: simple acids and bases; Lewis acids; organic acids; amines; organo metallic compounds; phosphines, etc.; carbonyls of Fe, Co, Ni.

(Examples quoted in the discussion referred to anhydrous ether and n-pentane solvents, temperatures between −40 and +40°C. and triphenyl phosphine as initiator.)

Comparative thermal stabilities of polymers produced in various ways were assessed using the 'K-test' involving the heat ageing of 3-7 mil compression moulded film which is subjected to cycles of creasing to failure. Bulk and conventional solution polymers show a 'degree of toughness' of zero cf. Delrin polymers at >100.

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Look at the two rubber test strips illustrated. Both were formulated with UOP 88 . . . but note how much more effectively the antiozonant worked when accompanied by this change in curing systems —a vast increase in resistance to cracking!

Help in achieving maximum effectiveness from UOP 88 or 288 antiozonants is available through UOP facilities and technical personnel. Just write or telephone our Products Department.

UOP ozone cabinets provide test conditions at a wide range of ozone concentrations.

The SBR specimens below were exposed to ozone at 100°F with 20 percent elongation for 52 hr. at 33 pphm ozone, then 187 hr. at 63 pphm ozone.

Carbon black—HAF (high abrasion furnace), Curing system—4 phr tetramethylthiuram disulfide; Hours to first crack—7 to 23.

Carbon black—HAF (high abrasion furnace), Curing system—2 phr sulfur, 1 phr N-cyclohexyl-2-benzothiazole sulfenamide. No cracks in 239 hr.

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Evidence from pyrolysis (yielding 99.6% H.CHO and 0.4% H_2O) and from infra red spectra suggests that the polymers are simple oxymethylene chains $[O-CH_2-]_n$ rather than 'sugar' structures $[-CH(OH)-]_n$. Osmotic pressure data gives $M_n > 2 \times 10^4$ and the D.P. is therefore >600.

End group analysis of the esterified polymer (acetate by saponification value, methoxy by a modified Zeisel method) gives good agreement with osmotic molecular weight determined at 90°C. using special membranes and this, together with the results of degradation experiments, is taken as evidence for relative freedom from branching in the structure.

In considering the relationship between structure and properties, the melting range lies above that of polythene and generally well below that of ptfe.

Comparison of densities shows the importance of crystalline packing:

Monomer M. Wt.	*Polymer*	*S.G. (23°C.)*	*Approx. m. pt.*
30	$(CH_2O)_n$	1.425	180°C.
28	$(CH_2)_n$	0.96	140°C.
100	$(CF_2)_n$	2.2	327°C.

As would be expected the crystallinity increases (from about 76→80%) as the quench temperature is raised from 0→100°C.

Mass Behaviour

The mechanical energy spectrum shows a glass transition peak at 200°K. (40-50°C. higher than for PE) and a crystal disordering peak at 400°K. The yield stress and modulus of the new material are respectively 10×10^3 psi and 5×10^5 psi as compared with 4×10^3 and 2×10^5 for PE, 2×10^3 and 1×10^5 for PTFE.

There is no technical solvent for the polymer at room temperature, but some phenolic compounds are suitable between 50-100°C. Solvent absorption studies on injection moulded bars shows that swelling occurs in many solvents, this being accompanied by a fall in tensile modulus. Maximum swelling is caused by solvents with C.E.D. close to that of the polymer; however, water causes only about 2% swell in one year at 16°C., although it is a solvent for low molecular weight polymers produced by other methods. It appears that all solvent absorption occurs in the amorphous regions of polymer structure and none in the crystalline regions. In summary, the structure of the new polymers consists of flexible chains (cf. PE) with regions of crystallinity inducing a rigid structure.

Potential uses of 'Acetal' resins include high impact stress applications such as car door handles and for silent gears. Impact strength is lower than CAB but shows better retention on repeated impact than other plastics materials with the exception of nylon and possibly also carbonic acid esters.

Points which arose from the discussion were:

1. The upper limit of temperature for load bearing applications: 60-70°C. continuous; 100°C. intermittent, where some creep is permissible.
2. Stability to weathering—light and moist atmospheres: Requires carbon black or other UV absorbers for good ageing.
3. Is it fibre forming?—Yes—covered by Du Pont patents!
4. Threshold decomposition temperature?—200-220°C. used for moulding, requires a heat stabilizer to give processing stability.
5. Mn/Mw ratio?—Ca. 2.
6. Polymers of acetaldehyde?—No information to offer.
7. Electrical properties? — Between Nylon 66 and PE.
8. Possible toxicity of formalin produced during moulding?—Irritant at <1 ppm level, well below toxic limit.
9. Use in bottle blowing?—Being investigated and largely dependent on permeability characteristics.
10. Can it be plasticized?—As with most crystalline polymers, ineffective.
11. How to make material of lower crystallinity? — Control of quenching temperature.
12. Why has this material not the rubbery toughness of nylon?—Nylon is <80% crystalline.

Polycarbonates

'POLYESTERS of Carbonic Acid' was the title of Dr Schnell's paper which he delivered at the Polymeric Progress conference.

Carbonic is the cheapest dibasic acid. Its unsaturated esters may be polymerized to produce linear thermoplastics.

It has been known for many years that low softening point, soluble polymers may be prepared from aliphatic dihydroxy compounds as source materials. Present processes employ aromatic dihydroxy compounds of general formula:
$HOC_6H_4—R—C_6H_4OH$ where R= — CH_2 —, —$C(CH_3)_2$—, —O—, —S —, etc. These may be prepared by condensation of phenols with alcohols or ketones. (Fig. 3.)

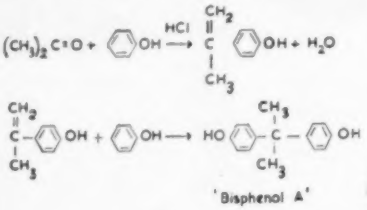


Fig. 3

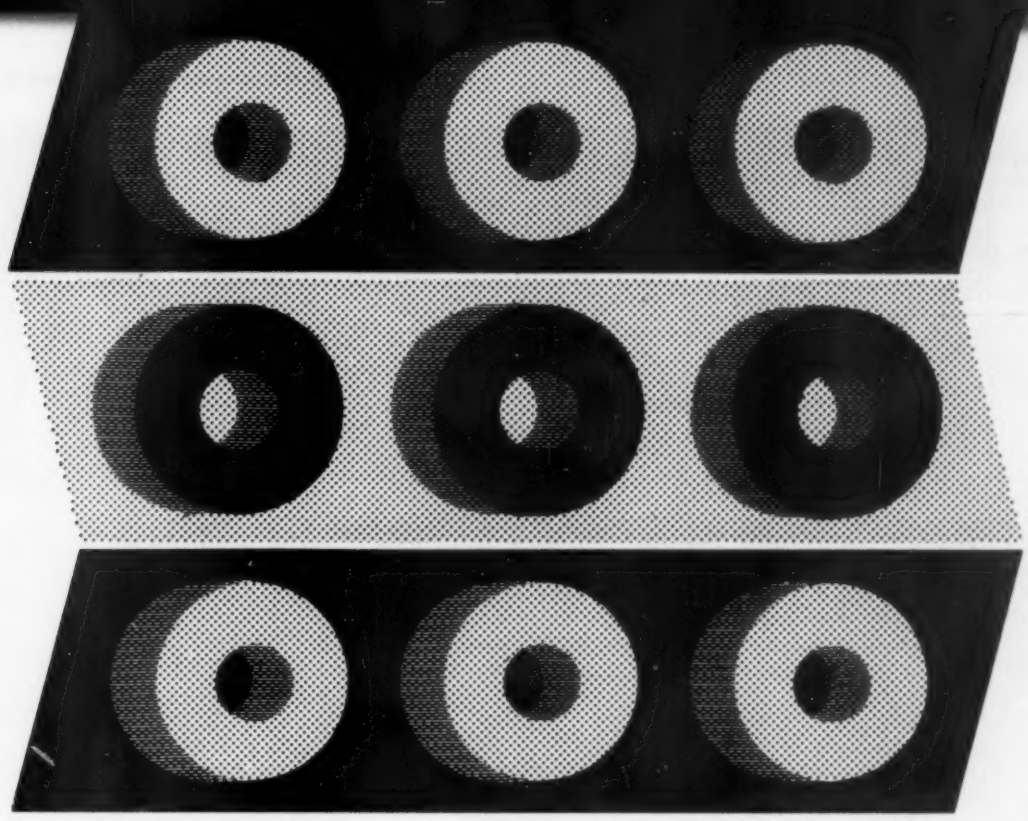
The other raw material is either phosgene ($COCl_2$) or *diphenyl carbonate* prepared by reaction of phosgene with phenol and purification of the product by distillation.

The two preparation methods are (1) Phosgenation and (2) Ester interchange. Simplified flow diagrams are shown in Figs. 4 and 5.

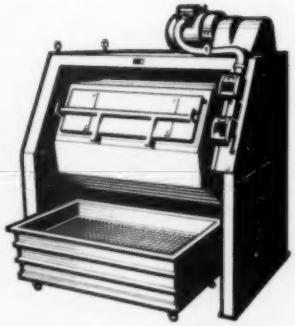
The phosgenation process (1) is most suitable for the production of high DP materials ($M_n > 2 \times 10^4$ is quite easy to attain). The ester interchange process (2) has the disadvantage of high melt viscosity which limits the DP attainable and the higher reaction temperature favours wasteful side reactions. However, there is advantage in avoiding the solvent separation step required in (1). Both processes require Bisphenol A of high purity.

Properties of the polycarbonates include high softening point, low tendency to crystallize below the second order transition temperature, transparency, low water absorption, good — light ageing, weathering, mechanical props., retention of electrical properties up to ca. 300°C. Polymers are soluble in a limited range of solvents, including methyl chloride, and are easy to process; they are resistant to acid reagents, many oils and solvents but show limited resistance to caustic alkali solutions and boiling water. Ignition temperatures are high and the materials are flame retardant.

For a typical polymer, $M_n = 3.3 \times 10^4$, serviceable temperature range −100°C. → +140°C., second order transition temperature 149°C., softening temperature 222—230°C. The materials show low cold flow under high loads for long periods and in fact show characteristics similar to those of polystyrene with absence of brittleness and heat sensitivity. Unstretched film has a tensile strength of ca. 820 kg./cm.^{2} with EB180% (of the order of CA but with better impact strength); orientation by stretching



Solve those de-flashing problems with **'DRIKOLD'** in the Columbian International sub-zero tumbler.



When small rubber components are frozen with 'Drikold'—I.C.I. solid carbon dioxide—in a rotating drum, flashes become brittle and break off with the tumbling action. Sub-zero de-flashing with 'Drikold' will increase production—for instance, complete multi-cavity mouldings can be tumbled to produce clean components efficiently and economically. I.C.I. Technical Service staff are available to advise on your problems, and will de-flash sample batches on request.

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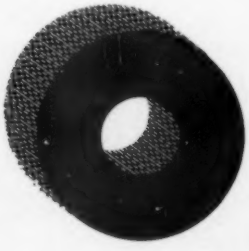

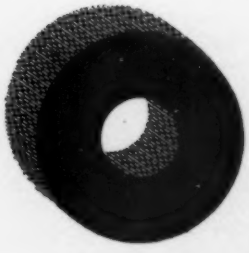

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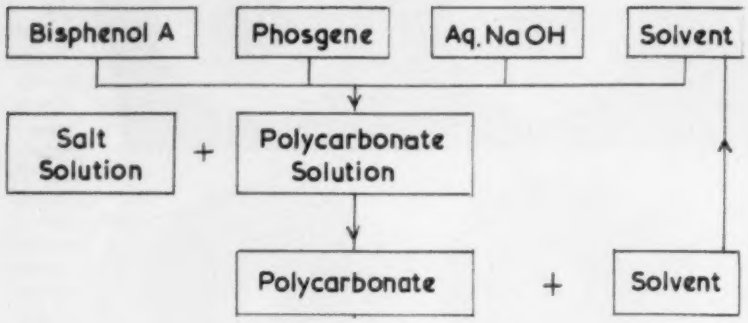


Fig. 4

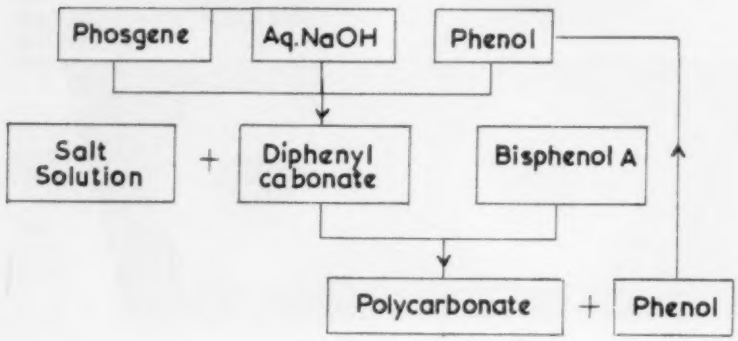


Fig. 5

raises the tensile figure to ca. 3,600 kg./cm.^{2} with EB20% (*cf.* polyamides).

Polycarbonates from other bisphenols show numerous speciality differences from the common bisphenol A based materials:

Polycarbonate from $HOC_6H_4—C(RR_1)—C_6H_4OH$ R	R′	Melt range °C.	Second order transition temp. °C.
-H	-H	Over 300	—
-H	$-CH_3$	185—195	130
-H	$CH(CH_3)_2$	170—180	149
-H	$-C_6H_5$	205—215	121
$-CH_3$	$-CH_3$-CH_3	205—222	134
$-CH_3$	$-C_6H_5$	210—230	176
$-CH_3$	$-CH_3$	220—230	149
$-C_6H_5$	$-C_6H_5$	210—230	121

Solubilities, etc., are also influenced and some of these materials find application in surface coatings.

Points from the discussion were:

(1) The possibility of interfacial polymerization systems?—Yes—using NaOH + Bisphenol A in water against phospene in MeCl.

(2) Correlation between hydrolysis and structure?—Those based on the more hydrophilic monomers degrade more rapidly.

(3) There is no evidence for tacticity in polycarbonates.

(4) Highest molecular wts. obtained by ester interchange ca. 5 x 10^4; by phosgenation ca. 35 x 10^4 (depending only on the purity of the Bisphenol A).

(5) There is no difficulty in devising a continuous production process.

(6) Glass transition temperatures were estimated by the n_D v. temp. or *p*. v. temp. relationships.

(7) Mechanical properties of polycarbonates from different bisphenols are all of the same order.

(8) Can one make rubbers with co-poly-diols?—That is possible.

(9) Can alcoholic dihydroxy compounds be used?—Yes—but the products have too low m. wts. for most technical applications.

(10) Polycarbonates have been observed to corrode Al or Zn deposited films?—No corrosion observed by Bayer chemists!

(11) An argument developed between Dr Schnell and the Russian delegates as to the nature of the crystallites present in polycarbonates, whether they were 'spherulitic' in form or whether this was connected with the high impact strength of the material.

(12) Improvement on electrical properties above published figures by heating at 120°C. was reported.—Claimed to be due to removal of 2% residual methyl chloride from the polymer as supplied.

Polyolefins

THE last lecture delivered at the Polymeric Progress conference was called 'Polyolefins,' and was given by H. C. Raine (I.C.I.).

The three principal criteria influencing melting point are, he said, interchain cohesion, intrinsic stiffness and chain flexibility and spatial symmetry of the molecules.

The melting point of unbranched PE is 137°C. (*i.e.* the temperature at which the last trace of birefringence disappears under the optical microscope). Many complications exist in the structure of polypropylene which contribute to the heavy scatter of experimental points in the relationship between % crystallinity and melting point. Plotting melting point v. length of side chain for poly-α-olefins gives a relationship of the form shown in Fig. 6.

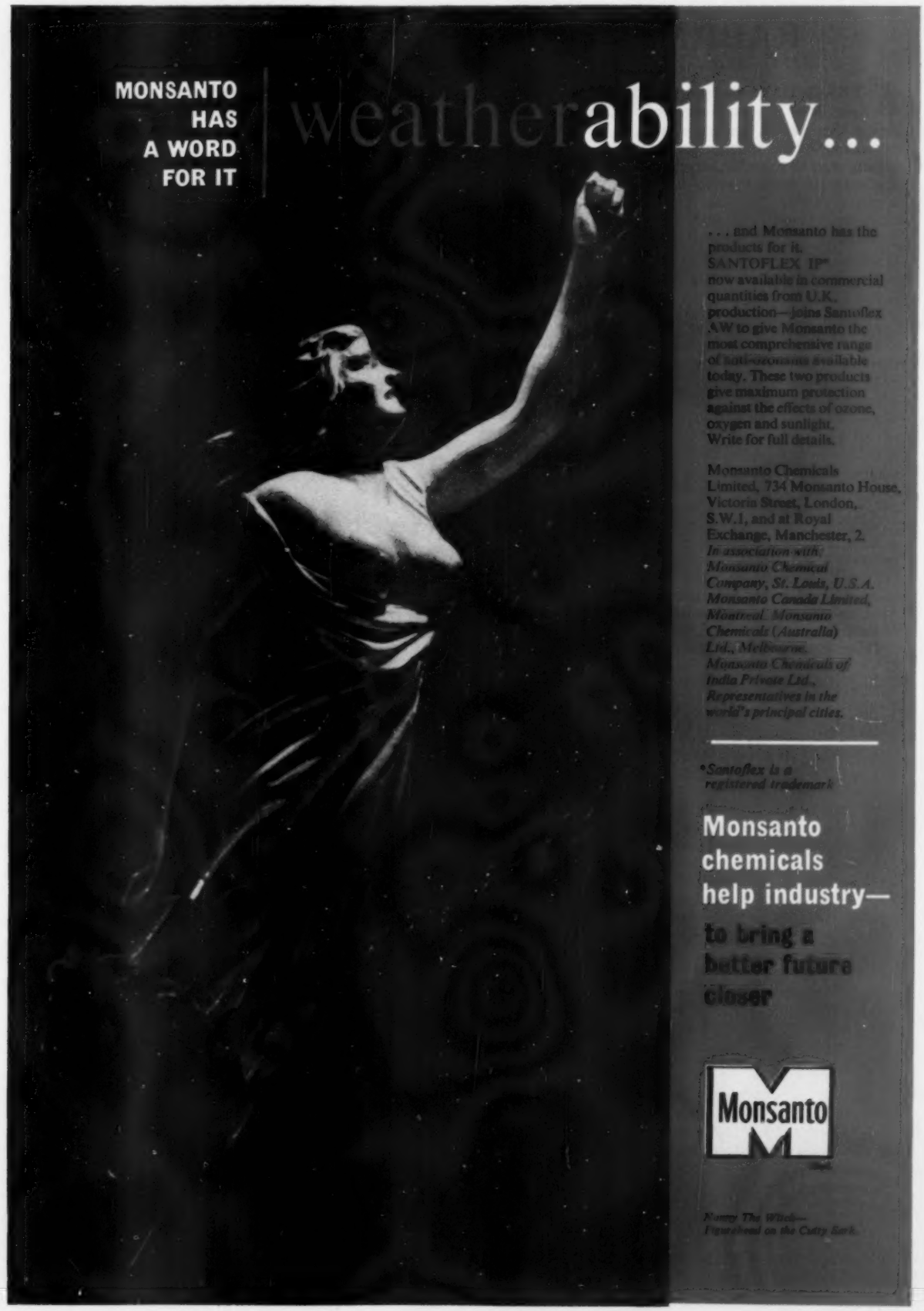
Longer more flexible side chains should bring down the melting point since they contribute to increasing molecular asymmetry. Results for $C_{4,5,6}$ side chains are anomalous although one reported value for C_5 (−50°C.) has not been confirmed. Polydecene—1 crystallizes with m. pt. 40°C. Side chains with more than C_{10} crystallize in the normal paraffinic structure as has been observed previously with the higher methacrylates. The materials behave like n-paraffins 'tied' at one end, the melting points should therefore coincide with those of 'free' n-paraffins of twice the length of the corresponding side chain. Quite good agreement is observed between the predictions of this simple rule and the observed values.

	M. pt., °C.
C_{10} Side chain	45
C_{20} Paraffin	38
C_{16} Side chain	70
C_{32} Paraffin	70

Non-Linear Side Chains

By calculation from figures for PP, the m. pt. of poly-3-methyl-butene-1 should be ca. 300°C. Two opposing factors influence this: (a) free rotation of the isopropyl group → lower m. pt. and (b) increased chain stiffness → higher m. pt. Comparing poly-4-methyl pentene-1 m. pt. 240°C. with poly-5-methyl hexene-1 m. pt. 125°C., it is clear that the latter compound allows freer rotation of the branched structure so relieving crowding close to the main chain. This is confirmed by studying tertiary side chains such as poly-4,4-dimethyl pentene-1 m. pt. 300-350°C., where

Continued on page 624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RABRM Symposium

A THREE-DAY symposium, held from May 2-5, will attempt to define the present requirements for rubbers in various spheres, outline the present state of scientific knowledge in the study of breakdown of rubbers, how breakdown may be predicted from accelerated tests and also indicate the ways compounding may assist in minimizing breakdown.

Called 'Service Life of Rubbers,' it is organized by the Research Association of British Rubber Manufacturers and will be held at the Shropshire Adult College, Attingham Park, near Shrewsbury.

The symposium will include a discussion on rubbers at high temperatures introduced by A. E. Eagles, with prearranged contributions from representatives of firms concerned with the production of acrylate rubber, fluorinated rubber and chlorosulphonated polythene. Dr W. F. Watson will give a lecture called 'Crosslinking and scission, and the properties of rubber networks' and Dr J. Scanlan will talk on 'The scientific interpretation of ageing tests with particular reference to the new stress relaxation methods.'

Other lectures will be given by R. C. W. Moakes ('Testing for light and ozone resistance'), J. T. Watts ('Chemical additives and ageing'), S. G. Fogg ('Compounding natural rubber for improved ageing resistance') and J. R. Pyne ('Compounding synthetic rubber for improved ageing resistance').

The last day will consist of a visit to the RABRM Laboratories, Shawbury, where demonstrations of the following ageing and high temperature test equipment will be given: (a) RABRM cell type ageing oven (Geer), (b) Wallace cell type ageing oven, (c) Carbon arc light ageing equipment (Fugitometer), (d) Xenon lamp light ageing equipment, (e) RABRM cell type oxygen ageing bomb, (f) RABRM ozone testing cabinet (for static and dynamic tests), (g) electronic tensile tester modified to conduct tests at high temperatures, (h) stress relaxation testing equipment.

Ekco Newcomers

Ekco Plastics will show several new additions to their range of 'Gold Seal' domestic ware at the International Hardware Trades Fair at Olympia (May 9-13).

Among the additions will be a bathroom cabinet in white high-impact polystyrene, produced as a single moulding, and a new small hotplate.

An extraordinary meeting of the Kampong Kuantan Rubber Company is called for April 29 to create 3.2m. 2s. shares and to effect the one-for-one scrip issue to holders of April 28.

IRI and PI in Scotland

SUCCESSFUL ANNUAL DINNER IN GLASGOW

THE second annual dinner and dance of the Plastics Institute and the Institution of the Rubber Industry, Scottish Section, was held in Glasgow on April 1. The chairmen, Mr R. A. L. Summers and Mr R. P. Yates respectively, were among the more than 180 members and guests who enjoyed a most successful and friendly evening. For the majority, it was also extremely energetic under the exhortations of Mr Kerriemuir-Gibson, an indefatigable MC.

In a brief welcome to members and their guests, Mr Yates said how pleased they were to have as their chief guest Mr C. H. Birkitt, a vice-president of the IRI, and expressed regret at the inability to attend of Sir John Dean, IRI president.

In a threefold toast, which he ascribed to the Caledonian sense of economy, Mr Birkitt proposed 'The Ladies,' 'The Guests,' and 'The Plastics Institute, Scottish Section.' He relayed a message from Sir John Dean, sending greetings and best wishes. Sir John, said Mr Birkitt, had especially hoped to be present because of his desire to encourage joint IRI and PI meetings.

The newer Plastics Institute, said Mr Birkitt, was progressing by leaps and bounds. He hoped that the interests of both the Plastics Institute and the IRI could be so dovetailed that an organization would emerge that would be second to none.

In proposing the toast of the IRI, Mr Summers said he was very pleased to be at a gathering of the two Institutes. Joint meetings between them were increasing, and this held good for both technical and social events. He hoped that the process would continue until welding was completed, under whatever name.

Mrs Summers and R. A. L. Summers at the PI/IRI dinner dance in Glasgow Mr Summers is chairman of the Scottish Section of the Plastics Institute

Prominent on the top table, to which, in true Scots fashion guests were led to the skirl of the pipes, were the Wallwork Cup—held for the second year running by T. W. W. Davie, and the Dick Trophy. After the dinner, the Dick Trophy was presented by Mr Andrew Aitken, R. and J. Dick Ltd., to Mr W. Alexander, last year's captain of the IRI Golfing Society, Scottish Section.

A number of prizes and gifts presented during the evening were donated by the following companies:

Albright and Wilson Ltd., R. and J. Dick Ltd., Shell Chemical Co. Ltd., The Geigy Co. Ltd., Distillers Co. Ltd., Goodyear Tyre and Rubber Co. Ltd., P. W. Hall Ltd., Edward McBean and Co. Ltd., M. Barr and Co. Ltd., I.C.I. Ltd., George MacLellan and Co. Ltd., India Tyre and Rubber Co. Ltd., and North British Rubber Co. Ltd., Dumfries.

IN SCOTLAND WITH THE PLASTICS INSTITUTE AND THE INSTITUTION OF THE RUBBER INDUSTRY

Among those present were *(left to right)*: **1. Robert P. Yates (chairman, IRI Scottish Section) and F. S. McElroy (Henry Gardner Ltd.); 2. Mrs C. H. Birkitt, Mr C. H. Birkitt (Hubron Rubber Chemicals Ltd.); 3. Ken Manock (Geigy Co. Ltd., secretary, Plastics Institute, Scottish Section) samples the contents of the Dick trophy; 4. Mrs Cumley, Mrs Lambert, Mr Cumley and J. Lambert; 5. W. Alexander, G. Kerriemuir-Gibson, John M. Gallie and Andrew Aitken (R. and J. Dick Ltd.) presenting the Dick trophy.** *(below)* **Following the piper** *(top right)* **Tom Davie, Mrs J. Lambert, J. Lambert, Mrs R. P. Yates, R. P. Yates, Mrs C. H. Birkitt and C. H. Birkitt.** *(lower left)* **Some of the I.C.I. party**

VIEWS and REVIEWS

COMMENT ON SCIENTIFIC AND INDUSTRIAL MATTERS

by **Dr Schidrowitz**

100,000 Tons to Nothing

WITH rubber selling at nearly 3s. a pound it is not surprising that *Foam* should find a market for about 100,000 tons *(dry latex)* but what is astonishing is that the Rubber *Sponge* has entirely disappeared from the London market. At least that was my experience in the London suburban market, where your reviewer recently made a voyage of discovery to find he was quite unable to find one in some half dozen high grade shops; not a single one regarded the rubber sponge as other than dead as the dodo.

At least only one shop admitted that there was such a thing, and well—I propose to give my experience on the subject shortly.

Compounding Transparent Rubber

Some improvements have been made in the transparency of vulcanized elastomers since the publication of earlier work on goods filled with reinforcing silica in 1957. This is stated by Ralph F. Wolf and C. C. Stueber in an article on 'Compounding Natural Rubber' in *Rubber Age* of March 1960 (p. 1,009). The transparency of the best natural rubber compound reported previously has been still further advanced by the use of additives which eliminate the opacity introduced by the zinc oxide needed for accelerator activation. 'Of much greater importance is the fact that very satisfactory transparency can now be obtained in silica filled butyl rubber compounds.'

'It was stated in the work cited above that "transparent sheets can be made from properly compounded butyl rubber loaded with reinforcing silica. Butyl is not a particularly good material to use for transparent stocks, however, because even the best compounds are much less transparent than those made with natural rubber, styrene-butadiene rubbers or nitrile copolymers."

'This is no longer true. In fact, silica-loaded butyl compounds have been developed with such good transparency that an important use may develop for them in the tyre manufacturing industry. Using transparent butyl stocks it is believed, will make it possible to spot incipient failure of curing bladders before they fail in actual service. Some additional notes on . . .' this subject runs to some seven pages of *RA,* but I must leave this enthralling subject for browsing at leisure.

Effect of Attrition on Carbon Blacks

A paper which will give much food for thought is one on 'The Attrition Process and its Effect on Carbon Blacks' by A. M. Gessler, of Esso Research, *(Rubber Age,* 1017, Vol. 86. 6, 1017). One has been tempted to think that so much has been written about carbon black that nothing remains to be said except details. But we had forgotten butyl. It had not apparently occurred to us that a new Lochinvar would arise and find that one could look at butyl as requiring assisting from the carbon black end to rescue by, say, some new accelerator or the like—because of its weakness or low unsaturation—or new form of sulphur, rather than an admission by a protagonist that one looks to a modification of carbon black, a fundamental change greater, perhaps, than from one of the two main forms of carbon to another, because:

'Of its low unsaturation, the commercial acceptance of butyl has depended on the use of some especially active or "ultra" accelerators such as the thiuram sulphides or the thiocarbamates. The much less active accelerators which are generally used with natural or styrene rubber lead to insufficient cure at practical curing times with butyl; even at best, to less than the optimum or desired cure.'

Well, we had thought that butyl did pretty well as regards curing but 'it had long been recognized' that the need for a separate and specific consideration of the butyl *reinforcement* systems had long been passed over much more lightly.

Reinforcement and vulcanization are almost equally requisites to obtaining the best properties in a tyre tread.

With this thought in mind it is the purpose of the present papers to show that, for these optimum properties, butyl requires not only 'ultra' accelerators but ultra reinforcing pigments as well.

It is along these lines that the author's thoughts have travelled in the reported research and especially active or 'ultra' carbon blacks are prepared by severe attrition. To come from the general to the particular:

In the reported research, especially active or 'ultra' carbon blacks are prepared by *severe attrition.* In the three papers the chemical and physical changes wrought in the carbons by that attrition are studied. In the second the profound effects of attrited carbons are discussed. The advantages which result from the use of attrited blacks in natural, styrene and *acrylonitrile* rubber are considered in the last paper.

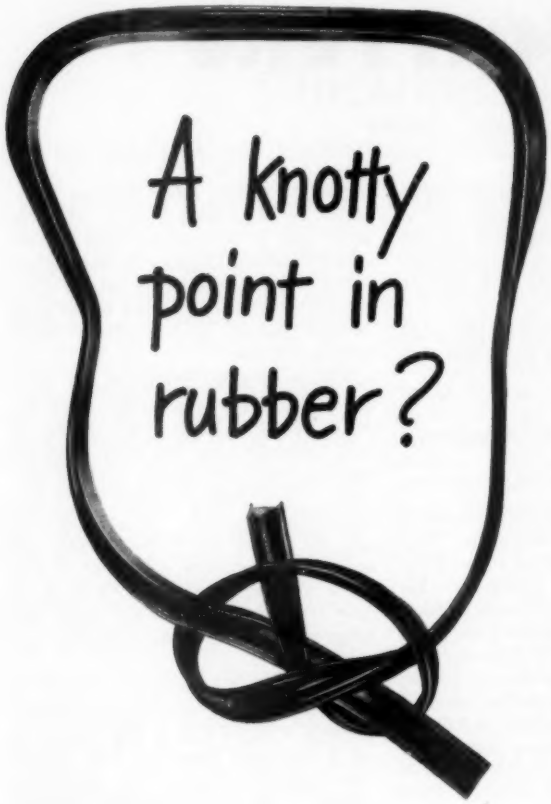
The extent of the chemical and physical changes which attend the attrition of carbon blacks is surprising . . . the results suggest a breakthrough in a much broader area *(than ensues from the process . . . the activation of solids is suggested?).*

Note

Technical Information Sheet No. 20—Construction Variables and Butyl Tyre Wear

A considerable amount of rubber is used to insulate power and communication wire designed for service under 600 volts. Two butyl compounds, one black and one light coloured, have been developed to meet these service requirements. The report discussing this is a reprint of the paper presented by W. F. Fischer and W. C. Smith of the Enjay Laboratories at the Signal Corps. 7th Annual Symposium in the US in December of last year.

PHILIP SCHIDROWITZ



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MEN *and* MATTERS

A Review of People and Events

by George A. Greenwood

FLOREAT industria! That was the keynote of all the news at the Easter week-end, recording the state of high prosperity which is being enjoyed by most of the big industrial companies. It can be taken, too, as a good (and fair) forecast of the general condition of rubber and plastics with which nearly all the great concerns are so closely linked.

Motor car and cycle output is at a record rate, and although there are tales that we shall not be able, in future, to sell as many to North America, the foreign markets are certainly being well maintained, for they are taking a little more than half of our total output.

Personally Conducted

Sir Miles Thomas, chairman of Monsanto, told shareholders at last week's meeting in London that results for the first quarter of the current year were 'even better' than in the comparable quarter of last year, and he instituted a new idea for his company by giving them a 'personally conducted' tour of the three factories with the help of a large number of 3-D colour slides. A very good idea too. There were so many men and women at the meeting that two 'houses' for the show had to be held.

An I.C.I. Chief

There has just come news from Melbourne of the death there of Mr Harry Hey, who both 'down under' and in this country occupied a dual role in industry and commerce. He was a famous metallurgist, but he was also an outstanding world figure in chemicals, which brought him into the orbit of plastics, as a director of I.C.I. Industries, Australia and New Zealand, Ltd. In fact, Harry Hey's versatility and range of interests, together with his attractive personality, were among his predominant characteristics.

Harry Hey was a Yorkshireman, born at Horbury, near Wakefield, 67 years ago, in an area where many of his relations still live, and he was educated at the now famous Wheelwright Grammar School, Dewsbury, before going with his family to New Zealand, and finishing up at Victoria University College. He joined Electrolytic Zinc in 1917 and was the company's chief metallurgist from 1927 until 1943 when he was appointed its technical superintendent. In 1944 he became a director, and in 1945-46 was the company's general manager. He was appointed managing director in 1947, and became chairman in 1952.

Mr. Hey was president of the AMI and M in 1943, 1944 and 1949. He was awarded the Institute's Medal in 1951 and the Kernot Medal in 1955. In 1953 he was president of the Fifth Engineering Mining Congress. He held a number of directorships other than in the EZ Industries group, one of which was of I.C.I. Australia and New Zealand Ltd., as already stated. He was a M.I.M.E., and hon. member of AIM and M and an F.R.A.I.C.

He leaves a widow, a son and a daughter.

Hardware

Very soon the International Hardware Trades Fair at Olympia will be upon us—it opens on May 9 and goes on until May 13. I gather that the show will be especially notable for the extent of the displays of household equipment made from plastics materials.

Another sign of enterprise and ingenuity comes from British Railways. The North-Eastern Region sends me a note to say that in the North-Eastern Region it has introduced a glass fibre/resin railway container, the first of its kind to be used in this country. It has proved itself in practice, too.

'Door-to-door' transport by containers, easily transferred between road vehicle and railway wagon at rail terminals, has for long been an integral part of railway freight services. This latest container has many interesting features. Measuring 7ft. 6in. by 6ft. by 6ft. it is only half the weight of a wooden container of the same size, and can carry a load of five tons, one ton more than the biggest of the conventional types.

Executive for Executives

A forward looking move from Commercial Plastics Ltd. is the setting up of a personnel department to handle executive appointments throughout the group. The new personnel manager is Michael H. Charlesworth, who is based at the group's head office in Grosvenor Street. Mr Charlesworth was previously assistant personnel manager for Quaker Oats.

E. H. Thompson has joined Chemicals Trading Co. as sales manager of all 'Fiberglas' products

As reported last week, members of the plastics industry and the Press were entertained by Tufnol Ltd. at the May Fair Hotel, London, when they were given a preview of a new colour film, 'Tufnol in the Making,' made by the Ellison Film Unit. My picture shows Mr David Radford, chairman of the British Plastics Federation, greeted by Mr A. E. Skan, managing director of Tufnol Ltd., and Mr B. S. Freeland, London manager, at the reception

Step Forward in Polymer Education

WELSH COLLEGE OF TECHNOLOGY OPENS IN SEPTEMBER

RAPID progress is now being made on the installation of equipment in the New Polymer Processing Laboratory at the Welsh College of Advanced Technology. The Polymer Processing and Polymer Evaluation laboratories are on the ground floor of a modern building now in the final stages of completion. This building was designed by Sir Percy Thomas and is situated at one end of Cardiff's famous Civic Centre in Cathays Park.

Excellent practical facilities will be available in these new laboratories. For the preparation of polymers there will be a five-gallon resin kettle and a one-gallon emulsion polymerization unit as well as glass equipment for preparations ranging from micro scale to twenty litres. Processing equipment will include two roll mills, an internal mixer and two extruders.

In the Polymer Evaluation laboratory there will be extensive testing equipment, for determining the mechanical and other properties of plastics and elastomers. The equipment includes tensile testers, plastimeters, and machines for testing hardness, flex cracking and abrasion resistance.

These new laboratories are to be operational for the beginning of the next academic session, September 1960. Two separate day release courses will prepare students for the Plastics Institute Diploma examination and for Licentiateship Examination of the Institution of the Rubber Industry. Future plans include a course for the Higher National Certificate in Applied Chemistry with polymer chemistry as the special subject.

In the coming session two courses at post graduate level of special interest to polymer chemists will be offered. The first of these, in the Michaelmas term, will be entitled 'The Chemistry of some Plastics Materials'; and the second, in the Lent term, is on 'The Physical Chemistry of Polymers.' Several well-known lecturers have agreed to speak on these two courses.

Staff work on this new venture at the Welsh College of Advanced Technology is in the hands of Mr A. H. Henson, head of the Department of Chemistry and Biology, and Mr B. Ellis, senior lecturer in Chemical Technology. Full assistance is being given by the South Wales and Monmouthshire sections of both the Institution of the Rubber Industry and the Plastics Institute.

Cycolac Prices Down

The Anchor Chemical Co. Ltd., Clayton, Manchester 11, distributors of Cycolac for Marbon Chemical Division of Borg-Warner Corporation, announced last week price reductions, effective March 1, new prices for Cycolac high impact ABS resin as follows:

	20,000 and over, per lb.
	s. d.
Cycolac pellets T, H and L grades:	
Natural	4 3
Standard colours	4 5
Custom colours	4 5
Pemium colours (including metallics)	4 7
Cycolac powder T, H, L and LL grades:	
Natural only	3 11
Cycolac pellets for pipe fabrication:	
Cycolac C (black only) ..	4 11
Cycolac LL (black only) ..	4 3

All prices are delivered address UK. Premium charged for smaller quantities.

Question Corner—114

(Second Series)

439. Of what importance is film brittleness, as distinct from low temperature brittleness, of polythene film?

(Answer next week)

Answer to Question Corner—113

438. Isocyanates are used in certain reactions because they will react with, and add to, any chemical compound containing an active hydrogen. The most important reactions using isocyanates is with hydroxyl containing compounds which form the corresponding urethanes—such as glycols, polyols, polyesters and various polyethers.

The urethane reaction has been studied with reference to the activity of alcohols and it has been found that primary alcohols react about three times as fast as secondary alcohols, while tertiary alcohols react very slowly.

One important reaction is that between water and isocyanate in which the water adds to the isocyanate to form an unstable complex which decomposes to the corresponding amine and carbon dioxide. The amine reacts with another isocyanate group to form a symmetrical urea, and the water reacts with two equivalents of isocyanate. With polyisocyanates, the reactions form polymeric products which are infusible and insoluble. Advantage of this is taken in polyurethane foams to introduce cross-linking.

This reaction with water is a means of producing gas for foaming—but is something to be avoided in other applications. Addition reactions of isocyanate with various compounds having active hydrogen is reversible when heat is applied. Compounds of urethanes of primary alcohols will regenerate isocyanate when heated above ca.260°C. This has been used for various applications, such as adducts obtained from phenol and isocyanates, which are stable at room temperature but will regenerate isocyanates at 160°C., the latter may then react with a hydroxyl group to form a more stable linkage. It is thus possible to have a one-component system consisting of a polyester and an isocyanate generator with prolonged stability on storage.

(Another question next week)

Polly Ester Says . . .

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Bridge fitted with Epoxide Resin

THE Red Jacket Pill Bridge on the recently completed second section of the Neath By-Pass in South Wales, includes a novel use for epoxide resins. It was designed so that it could be erected over a tidal creek in the mud flats of a river estuary without the use of temporary supports.

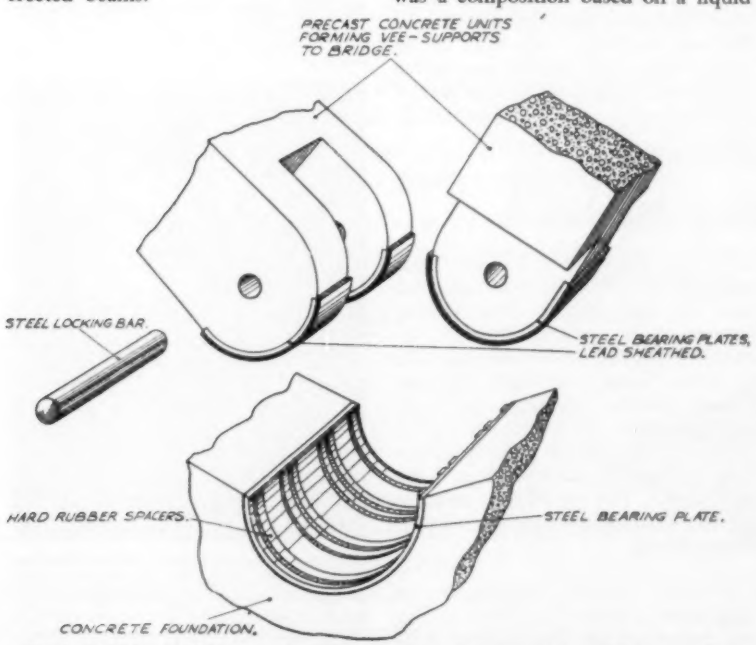
The bridge is a three-span continuous reinforced concrete structure on Vee-supports which hinge on two reinforced concrete foundation beams supported on pre-stressed concrete piles. There are 20 pre-cast concrete Vee-support units standing on each piled foundation, of which 10 are inclined inwards and 10 outwards. The outward lying units are buried in the approach embankments and at their lowest ends are interlocked with the inward lying units. The deck of the bridge consists of three sets of pre-cast pre-tensioned concrete beams, one set for each span.

Three deck beams of each of the outer spans were erected with pairs of the support units to form triangular frames which were then counter-weighted before the erection of the centre span beams. The spaces between the deck beams were filled with *in-situ* concrete to complete the deck, all temporary supports and formwork being suspended from the erected beams.

The original intention was that the lower ends of the Vee-support units should be fitted when cast with convex mild steel bearing plates which, on erection, would fit into concave steel plates cast in the concrete of the pile capping beams. It was found, however, that it was impracticable to obtain the necessary degree of accuracy, when setting the bearing plates during the manufacture of the precast concrete support units and concreting of the pile capping beams, to ensure an acceptable fit of the bearing plates on erection. It was therefore decided to create an artificial gap between the plates and to fill it with some suitable material. The gap was formed by placing hard rubber strips of $\frac{1}{4}$in. initial thickness between the bearing plates, and the material used for filling the gap was a composition based on a liquid 'Epikote' epoxide resin manufactured by Shell Chemical Co. Ltd.

This was chosen because of its high compressive strength and low shrinkage properties, bearing in mind that the weight of the superstructure to be carried on the bearings was 3,800 tons. The composition develops a high bond with steel and concrete, and in order to provide for the slight rotation of the support members under load, it was necessary to isolate the upper bearing plates from the resin. These plates were therefore sheathed with lead sheet.

Preliminary trials had shown that the hot resin composition would completely fill the gap when poured from one side of the bearing, and no difficulties were experienced with the use of the material on the site.



Exploded view of bearing. The resin composition was poured between the rubber spacers when the bridge supports were placed in position

Keeping the Old from the New

Polythene film has been used to prevent the fusion of two buildings, an old and a new in Hobart, Tasmania. Polythene film was draped down the side of an existing building. Then the concrete shuttering was placed in position and the wall of the new building poured alongside the wall of the old.

Forming a separation medium, the polythene film prevents adhesion between the two buildings. It also stops any moisture transmission from the new building.

Ferguson Shiers

The office and works of Ferguson Shiers Ltd., rubber and plastics manufacturers, Phoenix Mills, Failsworth, Manchester, will be closed during June 18—July 3 inclusive for annual holidays. No goods will be received or despatched during these weeks.

Mr Teo Soo Chaun, Mr Teo Soo Cheng, Mr Teo Soo Pin, Mr Tang Tah Cheong and Mr Saw Lwin have been appointed directors of North Hummock (Selangor) Rubber Company. Mr L. G. Byatt, Mr K. C. Pearce and Mr W. M. Morison have resigned from the Board. The company's capital was recently acquired by the See Hoy Chan Company.

NEW POLYMERS

Continued from page 614

the reverse process is evident. Cycloaliphatic side chains behave rather similarly *e.g.* polyvinyl cyclohexane m. pt. 342°C., polyallyl cyclohexane m. pt. 225°C. All these were prepared using Ziegler-Natta catalyst.

It is possible to introduce optically active centres (*e.g.* in 3,7-dimethyl octene-1) and it is found that the isomers have different melting points.

The glass/rubber transition tends to rise alongside the melting point. However, branching the side chain close to the main chain may be employed to raise the melting point and a long straight tail tacked on to the side chain to lower the glass transition point. In this way, the two may be separated and a polymer with a side chain of the form $-CH_2-C(CH_3)_2-(CH_2)_3-CH_3$ crystallizes and still maintains some order at +350°C. although the rubber/glass transition temperature is only −15°C. It is possible to draw fibres at room temperature.

The impact of new tailor-made polymers of this type is limited by the high prices of many of the higher branched chain olefins. It would appear that immediate prospects favour polypropylene (250,000 tons/year—shortly) and possibly polybutene-1 as second choice but the future depends very much on future advances in the petrochemical field.

In the discussion, points raised included the relative futures of PE's and PP's, butene-ethylene copolymers, developments in highly crystalline polyolefins, the contribution of the polar effect of substituents as opposed to their steric effect, the weakening effect of the presence of tertiary carbon atoms in the main chain on oxidation resistance, the 'building in' of adhesive properties into the structures, post-forming rearrangements leading to increase of stiffening in PP which cannot be attributed to further crystallization.

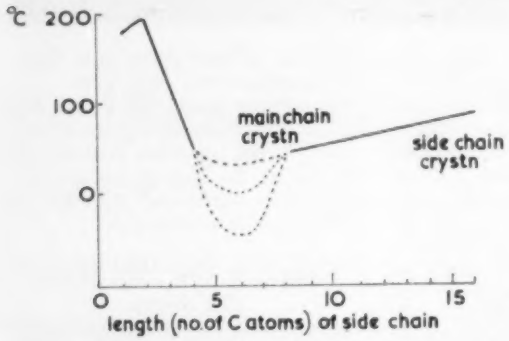


Fig. 6. Variation of melting point with length of side chain

Overall impressions of the conference were that this was one of the most worthwhile meetings ever to have been organized by one of our Polymer Institutes and it is to be hoped that it will set the pattern for many such occasions in the future.

—D. A. S.

British Standards

Cotton Fabrics for Rubber Footwear

This revised booklet (BS 1167) is the third edition, and the number of standard constructions has been reduced from 23 to 14. Eight of these were specified in the 1948 edition, but six new ones have been evolved from a comprehensive review of other fabrics currently being manufactured, and are specified in terms which will admit most of the cloths whose application in the manufacture of rubber footwear is established in trade practice.

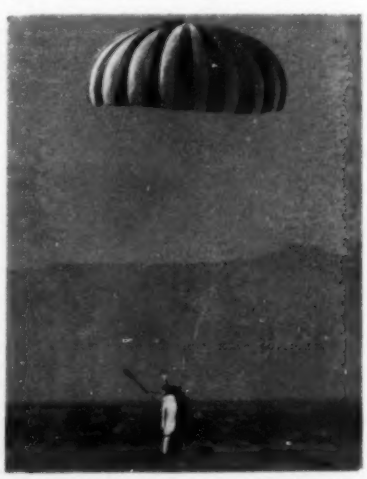
Butyl Rubber Components

This new publication (BS 3227) is the most recent addition to a series of British Standards on synthetic rubber vulcanizates intended primarily for use by Government departments. The butyl rubber vulcanizates are classified according to hardness into five compounds numbered B2—B6 inclusive. They are for the production of items such as sheets, washers, strip, gaskets, moulded articles and wrapped tubing.

Requirements are specified for physical and chemical tests; and an appendix tabulates mixes that have been found to give vulcanizates complying with the requirements of the standard.

The address of the British Standards Institution Sales Branch is 2 Park Street, London, W.1.

According to a survey of Brazil's economy last year, production of rubber increased by an estimated 2%, as against an increase of nearly 15% in 1958 when the economy was recovering from the 1957 recession.



This encapsulated seat, shown floating to earth in recent US Air Force tests at the Salton Sea, is said to give maximum protection to B-70 crew-men in emergencies. A specially designed rubber bag, made by B.F. Goodrich Aviation Products, at bottom absorbs the landing shock.

Injection Moulding Machines

The Western Automatic Turning Co. Ltd., P.O. Box 131, Bellville, Cape, claim to be the first firm in South Africa to manufacture injection moulding machines on a commercial basis. These machines are being sold under the trade mark of Watco. The manufacturers state that these machines are worked by compressed air at pressures from 80lb. to 150lb. per sq. in. This means that the device can be worked by the types of air compressor usually installed in South African factories. A one-horse power compressor could thus work two of the injection moulders at their full capacity. A strong plate valve provides the air control, and with an air pressure of 150lb., a piston pressure of 3,500lb. per sq. in. is secured. This machine has a body of solid construction in steel plate. The closing mechanism, on the vice-principle, includes a spindle 1¼in. diameter with an acme thread. A solid phosphor bronze injection cylinder is fed automatically with the plastic through a large capacity hopper, putting in the exact amount of material needed for each shot. The machine is suitable for the short runs often necessary in South Africa.

Foreign capital investments in Argentina in respect of rubber during the period of the Stabilization Programme totalled an estimated US$1,700,000.

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Pumps and Pipes

COMPRESSED AIR EXHIBITION PREVIEW

DELEGATES from more than 30 countries will attend the first Compressed Air and Hydraulics Exhibition at the Empire Hall, Olympia, from April 25-29. Response to the second European Fluid Power Conference, which will be associated with it, has been so great that closed circuit TV will transmit the proceedings to an overflow meeting.

Exhibited by Sutcliffe Hydraulics Ltd. at the Compressed Air and Hydraulics Exhibition will be a hydraulically-operated rubber bale cutter. This has a power - operated table on which rubber bales up to 2ft. 6in. long x 2ft. 0in. deep x 2ft. 0in. high may be placed. The bale is traversed under a hydraulic power-operated blade manually controlled for cutting the rubber into any desired thickness as the table is moved forward under the blade. Main exhibit will be a variable flow pump

The Oil Feed Engineering Co.—the high pressure hose division of BTR Industries—will show its standard range of hose and couplings, both for hydraulics and extra high pressure air services. Also on the stand will be a range of polythene thread protectors, the swivel elbow, the extensible hydraulic link and new easy fit couplings.

The main feature on the Ronald Trist Stand will be the Seatrist SCN Ring, said to be an advanced design of hydraulic seal combining the sealing qualities of homogeneous synthetic rubber with the strength of laminated fabric. This seal will be shown in a giant photograph, and its principles will be demonstrated by means of a working model.

Also on view will be the Seatrist T-Y Gland, shown fitted to a water circulating pump in operation. This rotary seal claims to avoid all shaft and sleeve wear and to reduce maintenance to a minimum. It can usually be fitted to existing pumps without modifications having to be made. Other items will include examples of oil seals, 'O' rings, rubber and synthetic rubber mouldings, rubber-to-metal bonding, and other Seatrist engineering rubber products.

A new company, Turbomachines Ltd., will show a number of air turbines, which are said to be particularly useful for hand finishing operations on dies and moulds, especially when work calls for small diameter cutters. Gland packings, seals, and precision mouldings in fabrics, rubber, synthetics and silicones for a variety of hydraulic and pneumatic applications will be featured by B.A.L. Ltd., one of the Pulsometer group.

ASBESTOS SCARCITY

A. B. Davidson, president of the United Asbestos Corporation, has stated the possibility exists of a not too distant world scarcity of asbestos fibre. This is despite recent discoveries of additional ore deposits in Northern Canada. 'New uses for asbestos fibre will outstrip present capacity and will put pressure to producers to discover and develop new asbestos mines,' he said.

He noted that one development which could have spectacular effects on asbestos consumption was the introduction of the fibre into road building by its use in aspha-paving.

'This opens a vast new use for asbestos fibre in the road building programmes of this continent,' he said. 'Additional new uses for the fibre are continually being developed and it is our opinion what we must look forward to is not only a future scarcity of the fibre, but to higher prices as well.'

In line with this, United Asbestos recently announced the purchase for $1m. of a 50% interest in Thorold Concrete Products, a Niagara, Ontario Peninsula, manufacturer of concrete blocks, and the purchase for $60,000 of a 5% interest in Capital Concrete Products Ltd.

United Asbestos' mining facilities at Black Lake, Quebec, are now able to produce 7% (excluding USSR production) of the world's fibre supply. Mr Davidson added that the mine should produce between 75,000 and 80,000 tons of fibre, compared with about 50,000 tons in 1959.

Paris Conference

PLASTICS AND RUBBER

THE Journées Françaises des Plastiques et du Caoutchouc are to take place on May 16 to 19 in Paris. The programme of lectures includes papers on the following:

Determination of the characterization and heterogeneity of copolymers by light diffusion, by M H. Benoit, Strasbourg University. Technical and economic evolution of cellular rubbers, by M J. Le Bras, Institut Français du Caoutchouc. A paper on injection moulding machines by M P. Roesch, Union des Syndicats de la Transformation des Matières Plastiques, and on recent progress in electro-technical construction by M L. Blumenthal, Société Fibre et Mica.

Visits are planned to the Institut Français du Caoutchouc, the Laboratoire de Récherche et de Contrôle du Caoutchouc and the Centre d'Etudes des Matières Plastiques. A dinner is to be held at the conclusion of the proceedings. Details are available from La Société de Chimie Industrielle, 28 ru Saint-Dominique, Paris, 7e. Registration should be made before May 1.

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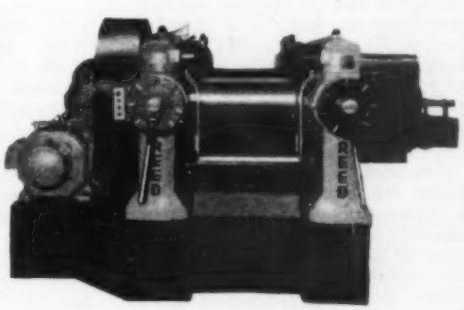

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Rubber Statistics

YEAR-END TOTALS FOR FRANCE AND GERMANY

THE Secretariat of the International Rubber Study Group has now issued details of the rubber position for France and Germany up to the end of last year.

France

French imports of natural rubber during 1959 totalled 108,413 tons of crude and 12,713 tons of latex, the total, 121,126 tons, falling well below the 1958 figure of 135,701 tons. Imports from Vietnam fell sharply from the 1958 figure of 60,927 tons to 38,366 tons, whereas supplies from Malaya rose from 57,291 tons to 61,984 tons. In addition to these two sources, Cambodia supplied 5,026 tons, French Africa 1,162 tons, Indonesia 2,620 tons, the Belgian Congo 7,071 tons, and Ceylon 3,230 tons. After allowing for exports of 737 tons, there remained available for consumption a new supply of 120,389 tons.

The actual natural rubber consumption total for the year was 132,268 tons, or about 7,000 tons less than in the previous year. Stocks of natural, which had amounted to 14,527 tons at the beginning of the year, had fallen to 8,554 tons by the end of December, this figure including 1,245 tons of latex.

Imports of synthetic rubber during the year amounted to 65,311 tons, and included 47,443 tons of S-Type, 7,041 tons of neoprene, 7,282 tons of butyl and 2,071 tons of N-Type synthetic. Of this amount, 46,844 tons came from the United States and 10,947 tons from Canada. Exports of synthetic accounted for 2,277 tons, and left a new supply of 68,961 tons after allowing for local production of synthetic, mainly butyl (5,927 tons).

Consumption of synthetic rubber during 1959 amounted to 68,712 tons, an increase of 14,000 tons compared with the 1958 figure, or approximately twice the increase that took place over this period in the case of natural rubber. Stocks of synthetic rubber at the end of the year stood at 9,003 tons, having risen by about 250 tons since the beginning of the year; S-Type synthetic accounted for 4,171 tons compared with 5,418 tons, while butyl stocks had risen from 1,511 tons to 3,184 tons.

Germany

Natural rubber imports into Western Germany increased from the 1958 figure of 132,609 tons to 144,758 tons. While imports from Malaya went up from 65,812 tons to 74,878 tons, those from Indonesia dropped from 31,180 tons to 18,023 tons. Other countries sending their rubber during the year included Ceylon (11,211 tons), Thailand (4,654 tons), Vietnam (14,232 tons), Burma (3,471 tons), British Borneo (1,086 tons), Nigeria (12,628 tons), the Belgian Congo (2,753 tons) and Liberia (1,177 tons). Exports amounted to 903 tons, leaving a new natural rubber supply of 143,855 tons, including 13,803 tons of natural latex.

Consumption of natural during 1959 rose from the 1958 figure of 129,300 tons to 140,109 tons, including 12,786 tons of latex. Stocks on hand at the end of the year amounted to 12,695 tons of crude and 1,574 tons of latex; this represented a decline during the year of about 1,000 tons in the case of crude.

Home production of synthetic during 1959 totalled 48,126 tons, or rather more than double the previous year's figure of 22,702 tons. Imports of synthetic went down from 39,792 tons in 1958 to 37,436 tons, 26,935 tons coming from the United States, 4,924 tons from Canada and 3,867 tons from Italy. Of the total amount, 11,765 tons were exported, leaving a new supply of 73,797 tons.

Consumption of synthetic rubber during these months totalled 68,937 tons, an increase of nearly 15,000 tons compared with the previous year. Stocks of synthetic rubber on hand at the end of December totalled 10,007 tons, having risen by some 3,000 tons during the course of the year.

Reclaim rubber production during 1959 amounted to 43,031 tons, while, after allowing for exports of 2,244 tons, consumption amounted to 41,736 tons, an increase of more than 6,000 tons compared with the 1958 figure. Stocks of reclaim on hand at the end of December stood at 4,026 tons, having fallen by some 900 tons during the course of the year.

Improved Catalyst for Urethane Foams

A new process for the production of a stannous catalyst with superior storage stability and uniformity of activity has been announced by Metal and Thermit Corporation. This catalyst (T-9) is claimed to be a marked improvement over stannous octoates previously available for the production of 'one shot' urethane foams, giving foam producers greater control in their formulations.

Book Review

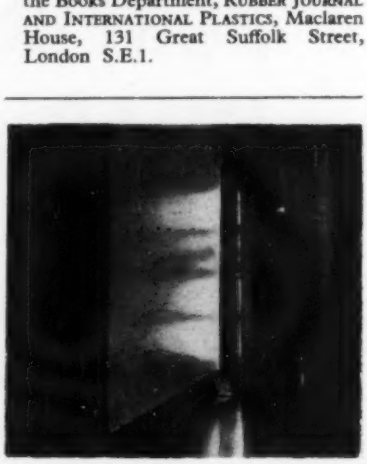
MARINE DESIGN MANUAL FOR FIBREGLASS REINFORCED PLASTICS. (Published by McGraw-Hill Publishing Company Ltd., 95 Farringdon Street, London, E.C.4. 400 pp. £5 16s. 6d.)

The rapid expansion of the application of glass fibre reinforced plastics laminates as a structural material in many fields has surpassed the accumulation of the necessary data and design information such as is available for other established materials.

Marine Design Manual is the result of a programme of research sponsored by the Owens-Corning Fiberglas Corporation to establish the potential value and limitations of this material, and provides a wealth of data to enable designers to meet the needs of a broad range of marine applications.

Boat hull design, materials and moulding methods, engineering properties of laminates and design of laminates are the main aspects covered, the major portion of the book being devoted to the presentation in graphical and tabular form of the latter two subjects. Design examples and illustrations of constructional techniques are given which show the entire development of various boat structures ranging from a 13ft. rowing boat to a 30ft. cabin cruiser. The basic types of glass reinforcing, the applications of polyester and epoxy resins and their catalyst and curing systems, and the fundamental methods of moulding are discussed, and while the book is of little practical value to the 'Do-it-yourself' expert working in the garage on a small boat, it should prove of considerable value to marine architects, ship and boat builders, and everyone who is concerned with glass fibre construction on a large scale.

∴ Copies may be ordered through the Books Department, RUBBER JOURNAL AND INTERNATIONAL PLASTICS, Maclaren House, 131 Great Suffolk Street, London S.E.1.



Stage in the manufacture of a large cinema screen—it has just been sprayed with an aluminized paint based on Geon PVC. The screens are made from Geon PVC sheeting supplied by Greenwich Plastics Ltd., and the process is said to give a superior reflecting surface without picture greyness

New leaf on the rubber Tree of Knowledge

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PATENT SPECIFICATIONS

The following information is prepared from published Patent Specifications by permission of the Controller of H.M. Stationery Office. The full Specifications can be obtained from the Patent Office, 25 Southampton Buildings, W.C.2, at 3s. 6d. per copy (including postage).

Polymerization of Diolefins

No. 826,990. The Firestone Tire and Rubber Co. Application and Filed, October 24 1956. Application in USA, November 3 1955 and August 9 1956. Published, January 27 1960.

Isoprene or other conjugated diolefin is polymerized by means of a catalyst comprising (A) lithium metal or a lithium compound in which the lithium exerts a strong reducing action, in close association with (B) a salt of a complex anion containing boron, silicon, arsenic or one of certain of the heavy metals. As compared with polymers hitherto produced by lithium-based catalysts, the polymers of the invention approach more closely in properties to Hevea rubber. They are free from *trans*-addition structure and are extremely high in *cis*-1,4-addition, usually containing about 93% or more of polymer of this configuration. In particular, when the diolefin is isoprene and when the (B) component of the catalyst is a chloroaluminate complex salt, the polyisoprene is very similar to Hevea rubber.

Although isoprene is preferred, other diolefins such as butadiene, 2-methyl-1,3-pentadiene, 2,3-dimethylbutadiene and cyclopentadiene may be used, as well as mixtures of diolefins or a mixture of a diolefin and another unsaturated compound such as styrene. Such unsaturated compounds should be free from ether, nitrile, nitro or other highly negative groups. All monomers should be of a high degree of purity.

The Specification includes a detailed discussion of suitable compounds for the catalyst and examples of the polymerization of isoprene by means of catalysts prepared according to the invention. Two of the samples of polyisoprene so prepared were compared with Hevea rubber in a pure gum stock, data being given for modulus, tensile strength and elongation at break for a range of cures.

Rubber-polymer Mixtures and Compounds

No. 828,895. The British Rubber Producers' Research Association. Inventors: D. J. Angier and W. F. Watson. Application, February 14 1955 and March 15 1956. Filed, May 7 1956. Published, February 24 1960.

Compounds or mixtures of natural or synthetic rubber and an olefinic polymer are produced by cold-mastication of a mixture of the rubber and the olefinic monomer under substantially oxygen-free conditions. The proportion of monomer must be such that the mixture of rubber and monomer is rubbery at the temperature of mastication. The cold-mastication can be effected in an internal mixer but is preferably effected in a suitable extruder. The use of an extruder has the advantages that under normal operating conditions, the exclusion of oxygen from the mixture undergoing mastication is sufficient to render any special provision for its exclusion unnecessary while the method is very suitable for continuous operation.

By combining natural rubber with certain monomers by means of the process, its resistance to swelling in certain solvents can be improved. On the other hand, some of the natural rubber-polymer compounds are soluble in solvents in which either natural rubber or the polymer are insoluble.

Sixty-one examples are given of the preparation of the compounds. The majority of these relate to the polymerization of a monomer in natural rubber; the monomers used include methyl methacrylate and other methacrylates, styrene, chloroprene, acrylonitrile, divinyl benzene and others. Other examples relate to the polymerization of methyl methacrylate or other monomer in neoprene, SBR, nitrile rubber, butyl rubber, polyisobutylene and Vulcaprene A.

Shorter Abstracts

Graft Copolymers. 823,462. Union Carbide Corporation. Filed, June 13 1957.—Graft copolymers of polythene are made by subjecting polythene to ionizing radiation of at least 1 megarep and then reacting the activated polythene with a suitable polymerizable monomer, *e.g.* styrene, vinyl acetate, methyl acrylate, vinyl chloride, etc.

Antioxidant. 825,603. The B. F. Goodrich Co. Filed, February 15 1956. —A non-staining and non-discolouring antioxidant for natural and synthetic rubbers comprises a reaction product of a bis(3-methyl-4-hydroxy phenyl) alkane and a ketone.

Adhesion of Rubbery Polymers to Tyre Cord. 823,282. Esso Research and Engineering Co. Filed, December 6 1956. — Adhesion of tyre cord to natural or synthetic rubber, particularly butyl rubber, is improved by coating the tyre cord with a phenol-aldehyde resin and then with brominated butyl rubber.

Copolymers Containing Fluorine. 823,974. Minnesota Mining and Manufacturing Co. Filed, September 3 1956. — Copolymers of hexafluoropropene and vinylidene fluoride are claimed. The copolymers have good chemical resistance and thermal stability.

COMPANIES in the NEWS

Dunlop Records

Dunlop Rubber's full year's results show that sales to customers increased by £18m. to £261m. in 1959, and the group trading balance was £2.7m. higher at £22.47m. Both these figures are records.

A final dividend of 1s. 2d. makes 1s. 6d. per 10s. ordinary unit on a capital increased by a one-for-four scrip issue and the Slazengers acquisition. Taking the scrip issue into account, the 1958 payment equalled 1s. 3 3-5d. per unit.

Group net profits advanced from £5,797,000 to £7,169,000 and the net balance attributable to the parent company of £5,953,000 compares with £4,757,000.

Reserves and surplus of the subsidiaries are increased by £1.6m. (£1.2m.) and those of the parent company by £1.5m. (£1.1m.).

Bayer Profits Up

Farbwerke Bayer AG, the third of the I. G. Farben successor companies to recently publish its accounts, reports a 22.3% increase in turnover to DM2,460m. in 1959 of which exports accounted for DM1,070m. worth against DM840m. in 1958. Net profits rose to DM105.6m. from DM92.4m., while investment spending totalled DM284.4m. (DM309.1m.).

Dr Ulrich Haberland, the chairman, said turnover in the first quarter of this year had exceeded that of the corresponding quarter of last year. Exports were likely to account for more than 50% of total turnover in 1960 while investments were likely to reach about DM330m.

US Rubber

Calling the business pessimism of the last few months unwarranted, Mr John W. McGovern, president of the United States Rubber Company, told an annual meeting of stock holders on April 19 that his company expects new records in both sales and earnings this year.

Sales, Mr McGovern said, should total more than $1,000m., while earnings should reach between $5.50 and $6 a share. For the first quarter of 1960, he added, sales approximated $254m. and earnings about $1.50 a share compared with $249m. and $1.55 in first quarter of 1959.

A new Lec International refrigerator contains a kick plate moulded in British Resin Product's Rigidex high density polythene. The plate incorporates a grille which allows free circulation of air beneath the refrigerator and is moulded by Craxfords Ltd.

The Firestone tyre factory at Brentford, Middlesex, is among plants to be expanded and modernized in a worldwide $120m. programme announced by the parent company.

Rubber and Plastics Stock Market

A REVIEW OF PRICES AND TRENDS

IT is not very often that we lead on City matters with a report on one particular company, and it is even rarer to award that position to a specific concern on two successive occasions. But we feel that anything that the giant IMPERIAL CHEMICAL INDUSTRIES combine has to report on its financial affairs cannot be placed anywhere else but at the top if only because it is so big and so very important to many other smaller pockets of industry. And from a stock market point of view in any case this is the leading equity in the whole of the industrial sections.

The full accounts of the company reveal the strength of the group's liquid position. At the end of December last, current assets, which included £21.3m. in cash, Treasury bills and marketable investments, exceeded current liabilities by the impressive figure of £118.5m. So good is the group's cash flow that it was able to add £12m. to liquid resources. Expenditure during the past year on construction projects was substantially lower. The figure amounted to £32.2m. compared with £45.3m. in the previous twelve monthly period and £50.6m. in 1957. Mr Paul Chambers, the new chairman, reports that capital spending in the early part of this year will again be less than in the preceding year. But his view is that this trend will be reversed towards the end of 1960.

Will the company be making an early new issue of capital? The figures now before shareholders suggest that the answer for the immediate future is 'no.' There is clearly little need for the board to hurry when the liquid position is so bonny and strong.

As for the rest of the stock market we sadly report that a bad attack of 'Amoryitis' has left share prices looking rather under the weather. Business has been extremely quiet for most of the past few weeks, and although the slide in the industrial share index is now substantial, it is out of proportion to the actual volume of selling that has developed. For the moment uncertainty continues to overshadow the scene. This, of course, has been chiefly created by Mr Amory's remarks about the possibility of another credit squeeze. In what form would this be applied? When will it arrive? These have been the two big talking points recently and have seemed to have taken the edge off investors' appetites. At their present level, however, we suggest that prices now discount news say of a rise in Bank Rate to 6%—if it should come, that is. It will be interesting to see if the recently idle investment institutions agree that some of the best equities now look attractive.

Meanwhile the flood of news from the company boardrooms continues. Good reception was given to the DUNLOP RUBBER preliminary results. They showed that sales last year increased by £18m. to £261m. The

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Share Price Movements

Par Value	Company	1958-59 High	Low	April 9	Latest
£1	A.E. Ind. Ord.	67/6	53/9	54/7½	51/6
5/-	Albright & W. Ord. ..	31/-	13/4½	29/6	27/6
£1	„ „ „ 5% Pref.	18/9	15/4½	16/3	16/-
5/-	Anchor Chemical Ord...	27/6	10/3	25/-	24/9
5/-	Andersons Rub. Ord. ..	4/6	1/1½	3/1½	3/1½
£1	Angus Geo. Ord. ..	47/3	25/3	47/3	47/-
5/-	Ault & Wiborg Ord. ..	24/-	11/6	23/3	23/3
£1	Avon India Rubber Ord.	47/6	35/6	37/6	37/6
£1	„ „ „ 6% Pref.	18/9	16/6	18/9	18/9
10/-	Bakelite Ord.	47/3	22/-	46/9	47/6
£1	„ 6% Pref. ..	19/6	17/6	18/-	18/-
£1	Baker Perkins Ord. ..	53/9	41/3	51/3	51/3
4/-	Bank Bdg. Rubber Ord.	3/7½	1/6	3/6	3/6
5/-	Boake (A) Roberts Ord.	30/3	12/3	30/3	30/3
£1	„ „ „ 5% Pref.	16/9	13/9	16/3	16/3
4/-	Brammer H. Ord. ..	18/3	9/6	18/-	18/-
10/-	Bridge, David Ord. ..	58/-	24/3	56/-	56/-
5/-	Bright, John Ord. ..	18/9	9/6	17/3	17/3
2/-	Brit. Ind. Plas. Ord. ..	13/6	6/9	8/3	7/1½
2/-	„ 10% (tax free) Pref.	4/9	3/-	4/9	4/6
£1	British Xylonite Ord. ..	90/6	46/-	90/6	90/-
£1	„ „ 5% Pref.	16/9	15/-	16/9	16/9
£1	BICC Ord.	61/-	44/6	58/6	56/3
5/-	BTR Ind. Ord.	13/3	8/1	13/3	12/3
£1	„ „ 7½% Pref. ..	24/3	20/9	23/9	23/9
£1	Courtaulds Ord. ..	67/9	20/-	66/3	61/9
£1	„ 5% 1st Pref.	18/9	15/7	17/3	17/3
£1	„ 6% 2nd Pref.	22/6	19/-	20/6	20/6
4/-	Cow, P. B. Ord. ..	8/3	6/6	7/10½	8/6
£1	„ „ 5% Pref. ..	15/6	12/6	15/-	15/-
1/-	Dannimac Mfg. Ord. ..	11/6	5/2	11/6	11/3
10/-	De La Rue Ord. ..	73/9	42/9	66/6	65/-
£1	„ „ „ 3½% Pref. ..	12/9	10/6	11/6	11/6
10/-	Distillers Co. Ord. ..	39/6	23/6	37/3	36/3
£1	„ „ 6% Pref...	23/-	19/6	21/3	21/-
£100	„ 5% Conv. Loan	£97	£92	£97	£97
£100	„ 5½% Unsec. Loan	£98½	£90	£92½	£92½
10/-	Dunlop Rubber Ord. ..	29/9	17/-	23/9	25/10½
£1	„ „ 5½% Pref.	20/3	16/3	17/9	18/-
£100	„ 3½% 1st Debs.	£78	£71½	£76	£76½
£100	„ 4½% 2nd Debs.	£88	£80½	£86	£86
£1	Eng. Elect. Ord. ..	61/-	37/9	42/3	40/6
4/-	Ebonite Cont. Ord. ..	15/3	11/-	14/3	14/3
£1	English China Clays Ord.	94/3	47/-	76/3xc	76/9
£1	Goodyear Tyre 4% Pref.	13/-	11/9	12/-	12/-
5/-	Greeff Chem. Ord. ..	33/3	15/-	32/1½	31/9

Par Value	Company	1958-59 High	Low	April 9	Latest
10/-	Greeff Chem. 5½% Pref.	8/9	7/6	8/9	8/9
5/-	Hackbridge Hldg. ..	19/9	14/-	15/7½	15/7½
4/-	Greengate & Irwell Ord.	7/-	4/-	5/9	5/9
£1	Harrisons & Crosfield Dd.	64/-	30/9	55/9	53/9
1/-	Hunt & Moscrop Ord...	2/6	1/1½	2/3	2/3
£1	Imp. Chem. Ord. ..	63/1½	32/9	61/3	58/-
£1	„ „ 5% Pref. ..	19/-	15/6	17/6	16/9
£100	„ 4½% Unsec. Loan	£90½	£84	£88	£87
£100	„ 5½% Conv. Loan	£196½	£178	£195	£186
1/-	Kleemann (O. & M.) Ord.	10/3	4/3	9/9	9/9
£1	„ „ 6½% Pref.	19/-	14/-	18/9	18/9
2/-	Lacrinoid Prod. Ord. ..	4/3	1/5½	4/-	4/-
5/-	Laporte Ind. Ord. ..	34/9	19/3	34/3	33/3
£1	„ „ 7½% Pref.	24/3	21/10½	23/9	23/9
£1	Leyland & Birm. Rubber Ord.	59/-	39/9	50/-	49/-
£1	„ „ „ 6% Pref.	19/-	17/-	18/9	18/9
2/-	London Rubber.. ..	14/9	6/3	12/3	13/-
£1	„ 6% Red. Cum. Pref.	20/-	16/3	18/9	18/9
£1	McKechnie Bros. Ord...	71/3	39/3	67/6	67/-
£1	„ „ 'A' Ord.	67/6	38/9	65/-	65/-
£1	„ „ 6% Cum. Pref.	17/-	16/-	17/-	17/-
5/-	Monsanto Chem. Ord. ..	27/9	14/9	25/3	25/9
£1	„ „ 3½% Pref.	13/6	12/-	13/3	13/3
£100	„ „ 6% Debs.	£104½	£101	£104	£104
£1	North British Rubber ..	21/3	15/7½	20/6	20/6
5/-	Plastic Enginrs. Ord. ..	28/-	10/3	28/-	23/-
5/-	Redfern Holdings Ord...	7/-	2/6	5/3	5/3
2/-	RFD Ltd. Ord.	6/9	4/-	5/6	5/6
£1	„ „ 5½% Pref. ..	16/6	12/-	13/9	13/9
2/-	Rubber Imp. Ord. ..	10/9	4/-	6/-	5/-
2/-	„ „ 'A' Ord. ..	10/3	3/6	5/6	4/6
£1	„ „ 5% 1st Pref.	13/3	10/-	12/6	12/-
5/-	Rubber Reg. Ord. ..	19/-	10/-	18/3	18/-
4/-	Shaw Francis Ord. ..	26/3	13/6	26/3	26/3
2/-	Silentbloc Ord.	13/-	7/6	12/6	12/6
5/-	Storey Bros.	36/-	13/1	35/9	35/-
2/-	Sussex Rubber Ord. ..	2/1	1/3	1/9	1/9
5/-	Sutcliffe Speak Ord. ..	15/6	6/3	16/-	16/-
£1	Turner & Newall Ord. ..	113/9	68/6	105/6	105/7½
£1	„ „ „ 7% Pref.	25/6	22/6	23/3	23/3
5/-	Universal Asbestos Ord.	43/-	14/3	39/6	39/6
5/-	Viscose Dev. Ord. ..	15/-	9/-	15/-	15/-
5/-	Warne William (Holdgs.) Ord.	19/3	10/9	18/3	18/3

Rubber Markets

LONDON

Although holiday influences have restricted business in the London rubber market during the week the recent decline in prices, which followed the terms of the US stockpile release, was brought to a halt. Prices are little changed or a shade harder compared with previous levels. News that Russia had bought another 4,000 tons from the UK stockpile had little effect.

Latest prices are as follows:

No. 1 RSS Spot: 34⅜d.-34½d.

Settlement House:

May 34⅜d.-34⅝d.

June 34⅜d.-34½d.

July/September 33¾d.-33⅞d.

October/December 33½d.-33¾d.

January/March 32⅜d.-32½d.

April/June 31⅞d.-32d.

No. 1 RSS cif basis ports:

May 34⅜d.-34⅞d.

June 34⅜d.-34⅝d.

Godown:

May 118¾ Straits cents nominal.

LATEX

Centrifuged latex per gallon in drums, seller, May 20s. 2d., cif European ports, Spot, seller, 20s. 8d. Bulk, 19s. 8d. Creamed, seller, May 19s. 8d. Normal, seller, May 15s. 8d.

AMSTERDAM

The Amsterdam rubber market ruled as under on April 19:

	Guilders per kilo	
No. 1 RMA	April 19	Previous
April	3.39	3.39
May	3.39	3.39
June	3.39	3.39
April/June ..	3.39½	3.39
July	3.29	3.29
August	3.28	3.28

Sales: Nil. Tendency: Quiet

DJAKARTA

One firm of brokers sold 30 tons of sheet No. 1 on April 19 at 45 rupiahs per kilo. During the day, buying interest became more active and prices advanced, surpassing previous levels. At the close, the market was steady and quiet.

	Rupiahs per kilo	
	April 19	Previous
Spot No. 1 Priok ..	44.00b	43.25b
Spot No. 2 Priok ..	43.00b	42.25b
Spot No. 3 Priok ..	42.00b	41.25b
No. 1 fine pale crepe, spot	39.00n	38.50b

Tendency: Quiet.

SINGAPORE

Conditions were quiet on April 19 and there was little change in prices. Dealers were reluctant to trade and business was confined to some selective shortcovering of nearby sheets. After hours, some trade buying was noted and the market finished quiet and steady.

	Straits cents per lb., fob Malayan ports to open ports	
	April 19	Previous Close
No. 1 RSS, May	119½–119¾	118⅞–119
June	118⅜–118⅞	118½–118¾
No. 2 RSS, May	117⅝–118¼	117½–118n
No. 3 RSS, May	114⅞–115¼	114½–115n
No. 4 RSS, May	112⅝–113½	112½–113
No. 5 RSS, May	110½–111	110 –111
No. 1 RSS, Spot	119½–119¾	119⅝–119⅞
No. 3 blanket, thick, remilled, crepe, May ..	111 –113	111 –113
No. 1 fine pale crepe, May ..	127 –129	127½–128½
2X thin brown crepe, May ..	111 –112	111 –111½

Tendency: Steady.

The Industries Syndicate quote latex, native produce, 60% centrifugal, packed in rectangular drums fob at 228.20n pence per gallon.

BANGKOK

No. 1 RSS

The price of No. 1 RSS at Bangkok on April 18 was 37.25 (37.50) US cents per lb.

NEW YORK

The New York rubber market ruled as under on April 18:

DEALERS' PRICES

	U.S. cents per lb.	
	April 18	Previous
No. 1 RSS, April ..	40⅜n	40⅜a
May ..	40½n	40½a
No. 2 RSS, April ..	40½n	40½n
May ..	40n	40n
No. 3 RSS, April ..	40½n	40½a
May ..	40n	40a
No. 1 RSS Spot ..	40⅜n	40⅜n
No. 3 amber blanket, crepe, June.. ..	39b–39½a	38⅜n
No. 1 latex thin crepe, April	45n	45n
No. 1 latex thick crepe, April	44½n	44⅜n

FUTURES—REX CONTRACT

	April 18	Prev. Close
May ..	40.15b–40.20a	40.10b–40.10a
July ..	39.50t	39.35t
September	39.00b–39.10a	38.80b–38.90a
November	38.50b–38.75a	38.35t
January ..	37.90b–38.10a	37.85b–38.05a
March ..	37.30b–37.60a	37.25b–37.45a
May ..	36.80b–37.10a	36.75b–37.00a

Sales: 10 Tone: Quiet

Rubber futures were steady on April 18 but trading was limited. Dealers reported that physical rubber prices were steady but the market was quiet reflecting the overseas holiday.

CEYLON

No. 1 RSS

The price of No. 1 RSS at Colombo on April 18 was 137¾ (137½) Ceylon cents per lb.

STOCK MARKET

Continued from page 631

group's trading balance went up £2.7m. to £22.47m. Both these established new records. Equity earnings work out at around 34% to cover the 15% dividend — a rise of 2% — 2½ times. Net profits have advanced from £5,797,000 to £7,169,000 after tax of £6,894,000 against £6,360,000.

From P. B. Cow came news that the dividend was to go up 2½% to 15% which came as a surprise after the directors' statement of last month. Net profits have expanded from £154,991 to £209,332 after a lower tax charge of £169,377 compared with £204,434. As for the negotiations for the sale of the subsidiary company a contract has been drawn and is now under consideration. Further details will be issued with the accounts in about three weeks' time.

Against the background of intensive competition in the cable industry the profits of BRITISH INSULATED CALENDER'S CABLES are excellent. Sales increased by £17m. to £128m. and the net profit from £3.2m. to £4.2m. While the dividend was repeated at 13½%.

BRITISH XYLONITE was another company to romp home with very fine results. Here the net figure comes out at £739,600 against £480,900 and the payment to shareholders is raised 5% to 20%.

Sir Miles Thomas, head of MONSANTO CHEMICALS was in cheerful mood when he met shareholders the other week. He reported that results for the first quarter of the current year were 'even better' than in the comparable period of last year.

Ramps use Jet Tyres

New jetway ramps are used in America that lead directly from DC-8 jetliners into San Francisco air terminal's second floor without exposing the passengers to steps or outdoor weather. They ride on two tyres of the same type and size used on commercial jetliners.

The tyres, made by B. F. Goodrich Aviation Products, carry 150lb. of air pressure and each one can support 22,300lb. According to B. F. Goodrich engineers, they were selected to transport the 107ft. long ramps due to their weight-carrying capacity and successful performance in jet aircraft service. Their use on jets make them readily available at all major air terminals.

Mr A. A. Buckler and Mr S. Perry have been appointed joint managing directors of The Baxter Group. The statement made in *RJIP* April 9 that 'Mr S. Perry, secretary of the Baxter Group, has been appointed joint-managing director of Rubber Improvement' is incorrect.

Industry INTELLIGENCE

Technical Data

Epoxide Floors

Epoxide resins, when cured, have good chemical resistance, are resistant to abrasion (particularly when used with appropriate fillers) and have good adhesion to many types of surface. Two methods which claim to give non-skid flooring have been developed. The first utilizes a heavily-filled resin/hardener mix and the other a resin/hardener mix, followed by an aggregate filler.

In the first technique, the components are mixed in a specified order and the composition trowelled on to the surface which can be either concrete, metal or wood. With the latter method, the resin/hardener mix is applied to the surface to be treated, the aggregate filler is then scattered over the coating until it is completely covered, and the composition consolidated by rolling. The coating is allowed to harden (24-28 hours at normal ambient temperatures) and any excess of aggregate swept away from the surface.

Full details of recommended mixes, including formulations for making chemically resistant flooring, are contained in Advance Information Sheet E.38, which is obtainable from Bakelite Ltd., 12-18 Grosvenor Gardens, London, S.W.1.

Thermal Conductivity of Sprayed Rigid Polyurethane Foam

The thermal conductivity of sprayed rigid polyurethane foam based on Daltolac 41/Suprasec D has been determined by the National Physical Laboratory by the method described in BS 874: 1956, Appendix A(1). The results are reported in Technical Information—Urethane PC/U.15, issued by the Polymer and Chemicals Service Department, Dyestuffs Division, Imperial Chemical Industries Ltd.

The foam formula used was as follows: Suprasec D, 186 parts by volume (206 parts by weight); Daltolac 41, 100 parts by volume (100 parts by weight). The foam was applied in layers of ½in. thickness at intervals of approximately 1 minute between layers and its overall density was approximately 3½lb./cu. ft. The thermal conductivity was 0.23 B.t.u./sq. ft./hour for 1 inch thickness and 1°F. difference in temperature, the measurement being made at a cold face temperature of 14°F. and a hot face temperature of 50°F.

Polysar Butyl 101

Polysar Butyl 101 is an antioxidant-free copolymer of isobutylene and isoprene, it is odourless, tasteless, non-staining and is resistant to heat, ozone, animal and vegetable oils and acids.

These unique properties have led to the development of many products which make use of some or all of these characteristics, a few of which are described in Polysar Technical Report No. 9: 2B, distributed in this country by Polymer (UK) Ltd., Walbrook House, Walbrook, London, E.C.4.

Uses for which the material has been found satisfactory, and which are detailed in the report include the manufacture of collapsible containers, gaskets and tubing, for the bulk transportation of animal and vegetable oils and for applications requiring resistance to heat and ozone, pharmaceutical bottle closures, conveyor belt covers for use in contact with cooking oils and fats, and chewing gum.

Linseed Oil as a Non-staining Antiozonant for Neoprene

Non-staining neoprene compounds of light colour and exceptional resistance to ozone may be obtained by using raw linseed oil as a plasticizer. Information on this use of linseed oil is given in Du Pont Elastomer Chemicals Department Report BL-364, available in the UK from the Du Pont Co. (UK) Ltd., 76 Jermyn Street, London, S.W.1. The report comprises a study of three Neoprene Type W compounds, two of which were compounded with conventional antioxidants while the third contained 15 phr of raw linseed oil. The test results show the effectiveness of linseed oil in providing a non-staining ozone-resistant neoprene compound.

Machines, Materials and Equipment

Cooling Tower

A complete packaged cooling tower small enough to be transported in a light lorry has been designed by Film Cooling Towers (1925) Ltd., Chancery House, Parkshot, Richmond, and has a basin, shell and splash tray made of resin-bonded glass fibre. The tower has been developed for industries needing a small scale, low-cost unit.

The tower operates on the induced draught principle; the fan and motor being mounted on the canopy, expel the air from the top at high velocity. The cooling air entering at the foot at a relatively slow speed is circulated evenly over the base area and throughout the interior of the tower. The packing provides the maximum possible heat transference in a small space. It is composed of a number of horizontal trays of parallel laths, each layer being at right angles to the trays immediately above and below it. The water is discharged from spreader troughs which run along the entire length of the tower and flows down the grid packing changing direction through 90° in every two inches down the whole depth of the tower. A continuously changing film of water meets the ascending air without obstructing its course and as no drops are formed, the loss of water by entrainment is negligible.

The unit is supplied ready for immediate operation merely requiring to be coupled after the ground has been suitably levelled. Since the pond basin is an integral part of the tower no concrete or steel tank and foundations are necessary. Provision is made for anchor bolts for use when installed on a roof top or in any location where high wind forces prevail. Built-in lugs are provided for crane slings.

Capacities range from 300 to 5,000 gallons per hour.

New Publications

Peroxides in Polyesters

Novadel Ltd., Lucidol Products Division, St. Ann's Crescent, London, S.W.18, have published an 111-page booklet entitled 'The role of peroxides in curing polyester resins and their influence on the physical properties of reinforced plastics.' This is divided into three sections as follows: (1) Theoretical Considerations; (2) Curing Methods of Polyester Resins; (3) Physical Properties; and is based on experiments carried out on several commercially available resins during the last three years.

Carbon Black Abstracts

'Carbon Black Abstracts' is a quarterly periodical prepared by the Cabot Technical Information Service in Boston, Mass., and distributed in the UK by Cabot Carbon Ltd., 62 Brompton Road, London, S.W.3. The latest issue, Vol. 8, No. 2, contains 176 abstracts on carbon black divided into four groups as follows: (1) Production and Processing; (2) Applications; (3) Fundamental Properties; and (4) Economics, Statistics and News of the Industry. Nearly 100 abstracts relate to the behaviour and use of carbon black in natural and synthetic rubbers, while 17 abstracts relate to carbon black in plastics and synthetic resins.

Blow Moulding

Baker Perkins of Peterborough, have issued a short leaflet on blow moulding using the Granbull 'Auto-Blow' system, which produces blown thermoplastic articles at the speed of the extruder. The leaflet briefly describes the system, and recommends an extruder to incorporate with it. Production capacity and moulds are dealt with.

From the same firm comes a leaflet dealing with the firm's service organization. A map is given showing the network of service depots, stretching from Glasgow in the north down to Cardiff and Exeter.

Future Events

PLASTICS INSTITUTE

Midlands Section.—Friday April 29 at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 6.30 p.m. 'Fibre Resin Preform Moulding,' by A. Lewin (Fibre Form).

Southern Section—Thursday April 28 at the Chemistry Department, Southampton University, at 7.30 p.m. 'Synthetic Jewels' by R. C. Chirnside (General Electric Co.).

INSTITUTION OF THE RUBBER INDUSTRY

Midlands Section.—Thursday April 28 at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 6.45 p.m. Annual general meeting.

Changes of Name

Plastic Garments and Bags Ltd. (515,391), 3 Red Place, Grosvenor Square, W.1.—Name changed to Waltron Property Co. Ltd.

Jamaica Agencies (London) Ltd. (632,793), manufacturers of plastic domestic products, etc., 89 Stoke Newington Church Street, N.16.—Name changed to Wipro Ltd.

Merlewood Plastics Ltd. (558,222), 3 Red Place, Green Street, W.1.—Name changed to Crasmar Property Co. Ltd.

Latest Wills

Mr. George Ingram, of 7 Pevensey Court, Bexhill-on-Sea, formerly of Hollybush Hill, Snaresbrook, Essex, chairman of the Board of Lea Bridge Industries Ltd., Southend, and associated companies, died on July 15 last, and left £41,605 gross, £15,891 net value. (Duty paid £1,608).

TRADE MARKS

Objections to the registration of any of the undermentioned applications may be lodged with the Comptroller-General of Patents, Designs and Trade Marks at the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, within one month of the date mentioned. The objections must be stated on Trade Marks Form No. 7, cost £2, obtainable through any money order office. The extracts—from 'The Trade Marks Journal'—given below are reproduced by permission of the Controller of H.M. Stationery Office.

DINETTE (794,702) Decorative sheet material made of laminations of plastics, and articles made therefrom, all being goods included in Class 17. Dinette Ltd., 12 Dock Street, London, E.1. (Class 17; February 23 1960).

NEOTEX (789,821) Composition materials of rubber, mastics and of plastics, for making floor and deck surfaces. Crossfield Products Corp., 3000 East Harcourt Street, City of Compton, State of California, USA. Address for service is c/o Haseltine, Lake and Co., 28 Southampton Buildings, Chancery Lane, London, W.C.2. (Class 19; February 23 1960).

VYNASOL (793,701) Paints, varnishes (other than insulating varnish), enamels (in the nature of paint), lacquers and suface coatings of plastics in the nature of paints or lacquers; anti-corrosives; preservatives against rust and against deterioration of wood. G. A. Willis (Middlesbrough) Ltd., Vulcan Paint Works, Avenue "C," Aycliffe Industrial Estate, Aycliffe, near Darlington, County Durham. (Class 2; March 1 1960).

VOGOSYNE (795,865) Non-mechanical and non-luminous signs of plastics. Vogue (Plastics) Ltd., 63 Paradise Street, Liverpool 1. (Class 20; February 23 1960).

LI-LEX (787,921, 787,923 and 787,925) All goods included in Class 10 made of plastics. P. B. Cow (Slough) Ltd., 470 Streatham High Road, London, S.W.16. (Classes 10, 17 and 19; March 1 1960).

NEW COMPANIES

Morrell and Harvey Engineering Co. Ltd. (652,183).—March 10. Capital: £1,000 in £1 shares. To carry on the business of precision, general, electrical, plastic, motor, heating, refrigerating, constructional and consulting engineers, etc. The directors are: Douglas B. Morrell and Lilian M. Morrell, both of 30 Heathervale Road, New Haw, Weybridge; Martin R. Harvey and Irene E. Harvey, both of 63 Crockford Park Road, Addlestone. Regd. office: 116 Station Road, Addlestone.

Corlite Plastics Ltd. (653,082).—March 18. Capital £1,000 in £1 shares. To carry on the business of manufacturing of glands, valves, and engineering products and accessories, etc. The directors are: Harold H. Cornwell and Mrs. Mildred Cornwell, both of 88 Acre Lane, Bramhall. Regd. office: Orrell Street, Openshaw, Manchester, 11.

Granville Rubber Co. Ltd. (653,022).—March 18. Capital: £3,000 in £1 shares. To carry on the business of manufacturers of and dealers in all kinds of goods made from rubber, latex synthetic rubber and plastics, including rubber moulds, all types of footwear, etc. The directors are: Thomas N. Atkinson, 1 Boundary Road, Wallington, Surrey; Mrs. Violet M. Potter, 95 The Causeway, Carshalton, Surrey. Regd. office: 95 The Causeway, Carshalton, Surrey.

Curfew Tyre and Rubber Co. Ltd. (653,184).—March 21. Capital: £10,000 in £1 shares. To acquire the business of a tyre and accessory distributor and petrol station carried on by A. Placito at Chertsey as Curfew Tyre and Rubber Co., etc. The directors are: Anthony Placito, Dorothy G. Placito and Peter J. Placito, all of "Wadhurst," Broomway, Oatland Park, Weybridge, Surrey; Anthony R. Placito, 10 Rosefield Gardens, Ottershaw, Surrey. Regd. office: 33 Pyrcroft Road, Chertsey, Surrey.

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ROBERT E. PRESSWOOD,
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April, 1960. (213)

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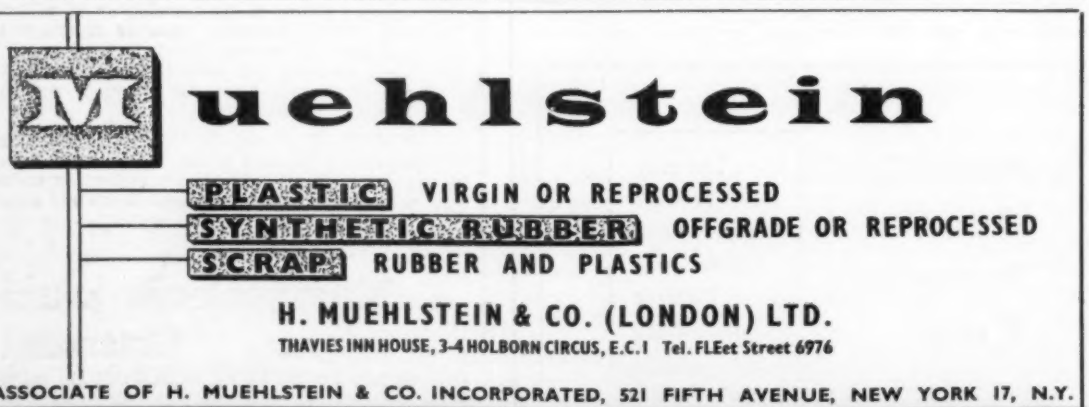
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